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March, 1941

"Let There Be Sight"

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Protection of Eyesight and National Defense*

Mason H. Bigelow

IN presenting this subject, Mr. Bigelow points out that protection of eyesight is vital to national service, as well as an important economic and social necessity.

THE chief problem before the nation today is national defense. Each of us has a part to play in the program that is developing for a strong and united America; and one of the things that we can do is to help in the campaign for protection of sight.

Although the organized movement for prevention of blindness began more than thirty years ago, the present national emergency gives added emphasis to its importance. The other day, for instance, we learned that defective vision is one of the principal reasons for the rejection of young men who are being examined for military service under the Selective Service Act.

Good eyesight, of course, is an essential requirement for those who wish to train as pilots in the air corps. Modern warfare also calls for large numbers of men to handle anti-aircraft guns; and this branch of the service can use only men with good eyesight.

Good eyes are necessary for skilled craftsmanship in the shop, as well as in the military service or on the high seas. Conserving the vision of American workmen is vital to national defense; for it is essential in the building of armament and the training of men to use defense equipment.

In normal times, the hazards to sight in industrial occupations are serious, and the expansion and speed-up of production resulting from the national defense program increase these hazards. Plans for the employment of large numbers of men in new jobs—working

* Presented over station WQXR, New York City, January 13, 1941.

in strange surroundings, perhaps in plants operating on a twenty-four-hour basis—are bound to add to the number of such accidents. Many of these new employees are untrained, or use operations that are unfamiliar to them. For this reason the Government has already created regional committees of safety experts, throughout the country, who are supervising the accident prevention programs in those plants where national defense materials are manufactured.

There are in the United States today about 8,000 persons who have been blinded by industrial accidents and more than 80,000 persons who have lost the sight of one eye as a result of such accidents. The number of men and women in industry who lose, permanently, part of the vision of one or both eyes runs into tens of thousands each year. Most of such losses and the resulting human suffering could have been averted.

Despite the fact that the amount of blindness has been reduced greatly in the past fifty years, through the development of medical knowledge and surgical skill, eye injuries from accidents of all kinds are as frequent as ever.

Many corporations have given serious attention to accident prevention and have thus brought about notable reductions in all accidents, including eye injuries. Progress has been made in the development of mechanical safeguards; and in some plants, where hazards to sight are prevalent, rules are enforced requiring all workmen to wear safety devices. In industry as a whole, however, the hazard of accidental eye injuries is insufficiently recognized and guarded against.

More money is paid by employers each year as compensation for eye injuries than is paid for injuries to any other part of the body. Recent studies indicate that the financial cost of industrial eye accidents in the United States is more than a hundred million dollars annually. In addition the accumulated social cost of such accidents is incalculable, and the effect on the individual worker in physical and mental suffering is devastating.

Years ago, blindness, as other misfortunes, was generally regarded as an act of God. We know now that—just as we have practically wiped out smallpox, yellow fever, diphtheria, typhoid fever and many other diseases—we can entirely eradicate, or greatly reduce, some of the major causes of blindness. The activities which

are being carried on for the prevention of blindness are directed not only to protecting the eyes of this generation but those of millions of children yet unborn. The educational and legislative drive, conducted during the past twenty-five or thirty years, has brought about a steady reduction in the amount of blindness from ophthalmia neonatorum, commonly known as babies' sore eyes. As a result of the adoption of laws—in nearly all the states—requiring doctors, nurses, or others in attendance to put prophylactic drops in the eyes of babies at birth, and the constant educational activities of the National Society for the Prevention of Blindness, the frequency of "sore eyes" as a cause of blindness among children admitted to schools for the blind has diminished by approximately 75 per cent in the last thirty years.

Progress is being made also in the reduction of blindness caused by syphilis and gonorrhea. It is estimated that more than 25,000 men, women and children in the United States—approximately one-sixth of the entire blind population—lost their sight as the result of these diseases. The situation is improving, however, with the growing success of the nation-wide fight to stamp out syphilis which is being carried on under the able leadership of Dr. Thomas Parran, head of the United States Public Health Service. It is encouraging to report that 20 states have laws requiring premarital Wassermann tests, and 18 states have laws requiring Wassermann tests for all expectant mothers.

Those of us who are associated with the movement for protection and preservation of sight are concerned not only with the problem of preventing blindness, but also with the conservation of vision among persons who have normal sight and the considerable number of persons not blind but with defective vision. You will get some idea of the extent of defective vision when I tell you that approximately 300,000 students in American colleges and universities—or nearly 25 per cent of the entire enrollment—are handicapped in their studies by various degrees of visual defects.

Modern educators are trying to find the boys and girls with seriously defective vision in the early years of school; and we have ways of helping them. Sight-saving classes for such children are maintained in schools throughout the country; and in these classes they receive a full and normal education while their remaining sight

is conserved as much as possible. They are also guided toward the selection of occupations that will not increase their eye difficulties. There are approximately 50,000 school children in the United States with such seriously defective vision as to require special educational facilities, and more than 8,000 of these children are now in sight-saving classes.

Suitable seats and desks are used, and particular care is exercised in regard to the lighting arrangements in the classroom. The books are usually in large type and much of the work is done on the blackboard. Every child is taught the touch system on the typewriter as soon as possible, so that the eyestrain of handwriting may be avoided.

All children are subject to eye accidents in school or at play. Boys and girls of high school age seem to be the most susceptible. They receive injuries in sports, through carelessness with pens or pencils, and in numerous other ways. Sometimes, high school students in physics and chemical laboratories have suffered painful eye injuries in doing experiments without the supervision of an instructor, especially when they have been using unfamiliar chemicals or have been working with inadequate facilities in their own homes.

Through constant educational efforts directed to children and adults, we hope to reduce the large number of eye accidents which are responsible for loss of sight.

In the struggle for protection of eyesight, the National Society for the Prevention of Blindness keeps abreast of all the scientific knowledge in this field. The Society is constantly engaged in public education, to inform the public in laymen's language about these scientific advances and how they may be applied practically in preventing blindness and saving sight.

Good eyesight for all the people of the United States was never so vital as it is today when each one of us is eager to contribute his share toward the national defense program. The nation is exerting every effort to be prepared and the protection of eyesight is now a matter—not only of good economics and humanitarianism—but patriotism as well.

The Problem of Sight Conservation as Related to the General Program of School Organization*

Richard S. French

THE relation of the school to the problem of sight conservation is presented by Dr. French, who enumerates some of the responsibilities which face the school.

IN STATES where the autonomous school district is still the unit of organization and administration, we can speak of a state program in any particular field only in the restricted terms of standards and of such financial aids as may be withheld if said standards are not observed. Thus the state school authorities may say that a teacher shall not teach in special classes without certain minimum preparation in the given field or certain experience in teaching under supervision in that field, or both. Similarly the State may say that it will not share in the payment of excess costs unless a given local district has proper housing and equipment for a special type of school work.

Aside from these very limited forms of control, the central authority of the State in school matters can make itself felt chiefly by way of leadership, by pointing out the desirability of segregations and class organization, of certain types of housing and installation, of specialized equipment and methods. Even so, the real initiative rests still with the local unit and the proper function of the State would seem to be one of encouragement, and of *being there when needed*, rather than any form of direct compulsion, however completely disguised that compulsion may be. It is indicative of the healthiness of our American balance between local autonomy and

* Reprinted, with permission, from the *Journal of Exceptional Children*, November, 1940.

the power of the larger units that, in California at least, the state services are hard put in attempting to keep up with local demands for a more comprehensive guidance and for certain specific aids. In the apparently simple matter of definition, for example, and of standards arrived at scientifically, the central authority cannot as yet meet local needs.

What I have to say about sight conservation will to a great extent be by way of commentary upon the above. With an expanded definition of sight conservation, it can be said in all safety that neither the State of California nor any local community has a comprehensive and integrated program, or has made more than a tentative venture into the field.

Definitions

There is a marked confusion in the public mind as to what sight conservation is. Because of the activity of lighting companies and makers of fixtures, the term has come in certain connections to connote better and more abundant artificial lighting. Similarly the activity of one professional group and of certain manufacturers has led to the popular conclusion that sight conservation is tied up with the sale of optical aids and correctional devices. In another direction the term implies large window spaces and Venetian blinds! School desks of a certain type and make come in for their share of notice. But some of the worst killers of vision and producers of visual disability pass with little notice; the bad print in cheap books, the atrocious multigraphed materials supplied especially in high school classes, the long periods of unrelieved reading, and the overemphasis of the visual element in education. These latter factors may be summarized in the failure of teachers and of educational leaders to take into consideration the fact that from the biological point of view the general process of education from the kindergarten through the graduate schools of our universities is artificial in the extreme and especially artificial in its unbalance of the visual elements. Until the printing press combined with universal education to enslave childhood and youth, sight conservation was only a minor problem concerned chiefly with diseases of the eye, their prevention and cure.

The first element in an adequate definition has to do with vision

itself, that is, with the quality and quantity of vision present at any given time in any given person. The second concerns whether or not the measured vision in the given case at any given time may be bettered or must remain the same or is likely to diminish. Strictly, conservation ought to connote keeping what one has without betterment or loss! However, if betterment is indicated, the question arises as to whether by operation, by medication, by visual aids, by regimen, such as dieting, by alternation of tasks, by environmental changes, such as increased lighting or modification of lighting or change of colors, and so on. If betterment is not indicated, the question arises how best to use what one has, involving the question in turn of the conditions of highest visual efficiency. If diminution or loss appears likely, the problem becomes one of salvage and of adjustment—physical and mental and social.

In all definitions it should be kept clearly in mind that the visual function is a part of a whole process, as the eyes are a part of the body and more especially of a highly complicated and imperfectly integrated nervous system. Poor eyes backed by an alert and finely co-ordinated brain may perform wonders even in such matters as reading, and perfect eyes in an imbecile only lend aid to imbecile acts. It must also be remembered that the eyes will stand more abuse than almost any other organ and operate under a range of conditions that makes their abuse slow in realizing its penalty. Thus we can see objects in an illumination of only 1/200 foot-candle and can still use our eyes effectively at 15,000 foot-candles, a range of 1 to 3,000,000!

Our definition must then consider efficient use under comfortable conditions rather than the lowest possible conditions of effective usage without direct loss. It must also take in the average or superior eye, as well as the defective eye. On this broad basis sight conservation is a term applicable to all children and youths in our schools and to all human beings everywhere.

Standards

When doctors disagree the layman is likely to be confused and in the end to fall back on his prejudices or on that to which he is accustomed. Three major groups have on a more or less voluntary basis attempted to set up standards that apply in sight conserva-

tion and in the effective and comfortable use of the eyes. They are that part of the medical profession that deals with vision as a specialization, the oculists and ophthalmologists; those that under many names approach the study of vision from the point of view of optical physics and whose knowledge of the eye and its bodily connections in anatomy and physiology are necessarily limited by their time of study; and those that in their study of vision make their approach from the point of view of environmental conditioning, particularly the phenomena of light and color. Each group has a large possible contribution and each can, with adequate education, supplement the work of the other two in arriving at a more nearly complete picture of what vision is and does. So far they have largely worked at cross purposes.

Controversy number one involves who may examine the eyes, to what extent and how effectively. Where pathology is involved, the legislation of most states turns the task over to the doctors of medicine. But the lack of physicians properly trained for adequate eye examination and treatment, and also the high cost of such examination, makes imperative the supplementary use of nurse examiners or optometric examiners or both. A second controversy arises from the inexperience of the average physician in matters of lighting and his traditional disregard of environmental factors in his preoccupation with pathology, which makes it necessary to fall back on the lighting expert, especially as regards such matters as mathematical ratios and equations that are usually beyond the physician's ken. The educator should come in as a synthesizer, with his more pragmatic view of tests and standards, and either get all other groups to work together or else get from each its contribution and reach his own conclusions. In any case three sets of standards must be worked out before much progress can be made. These sets are:

I. Standards of examination of eye structure and function in correlation with general health, leading to a determination of such segregation of special classes and assignment to special classes or schools as may be necessary.

II. Standards of environmental conditioning, applying especially to amount, quality, and direction of light, color schemes in rooms and the redirection and modification of artificial and natural light,

the combining of aesthetic effect with proper and adequate lighting, and the supplying of proper materials for visual tasks, such as print above the minimum size and contrast for comfortable and efficient reading for a given age and eye condition.

III. Standards of method and procedure, involving partial postponement of reading in earlier grades and finding of visually less exacting tasks, gradation of tasks according to exactions on vision, and such organization of work in the higher grades and high school as to give rest periods for the eyes, and the supplementing of the more purely visual methods with the use of the radio, *talking books* (for the drama especially), and other non-visual devices.

Agencies

California provides in its Bureau of the Education of the Blind and Bureau of Schoolhouse Planning two sources of standardization and control that can act most effectively only with more adequate *man power* and much more extensive organization and operation. The Bureau of the Education of the Blind, without personnel and without pay, can only speak as a voice from afar and perhaps pay an occasional visit. The Bureau of Schoolhouse Planning carries no mandate in a large proportion of the school building of the state and, of course, touches sight conservation only in the one matter of adequate and proper lighting. The influence of the latter agency has, however, been felt throughout the state in raising standards in both elementary and high school building and has always been on the side of better vision. Both bureaus have largely extended and augmented their programs through publication and through publicity, such as the preparation of this paper.

Locally at least five cities of California have some organization, effective or under way, in the matter of special education and hence either have or have in prospect organization for sight conservation. Two or three counties are following the lead of these cities; but even better is the spirit of interest and willingness pervading the whole school system of the state.

In addition to the more strictly educational forces the public health organizations are vitally interested and active. At least two voluntary organizations have done extensive publicity work North and South, helping to awaken both teacher interest and general

public consciousness. Courses have been fostered in our universities and colleges, both by the National Society for the Prevention of Blindness and by local agencies. These courses have reached a fairly large number and, while too short for adequate training, have at least aroused interest and a desire for more training.

What the Local School May Do

1. All principals and teachers may be conscious of the problems of sight conservation and of effective and comfortable vision under the conditions of classroom, laboratory, library, sewing room, shop, gymnasium, and playground.

2. They may likewise know the general hygiene of the eyes and the requirements of the usual school tasks involving visual effort.

3. They can acquaint themselves with such visual and lighting standards as those set forth by the National Society for the Prevention of Blindness and the Illuminating Engineering Society.

4. They can urge adequate lighting and proper painting in all rooms and usually secure action.

5. They can back a program of eye testing and secure local cooperation.

6. They can develop a consciousness of eye care among their charges, applying not only to the tasks of the school but to automobile driving and home tasks and elsewhere.

7. They can, through reading and by inviting specialists to their meetings, become intelligent and even expert to a degree in matters of visual environment and eye care.

8. They can counteract the propaganda of self-interest and of extremists by taking a sane attitude and a middle course.

9. They can effectively aid sight saving by giving out for class use only comfortably legible materials and by introducing an ever-increasing percentage of nonvisual tasks or tasks involving only the coarser aspects of visual usage. They can also introduce eye-rest periods of two or three minutes in the midst of fine or exacting visual work.

Functional Lighting in the College*

John O. Kraehenbuehl

DR. KRAEHENBUEHL discusses the problem of lighting in college as related to the eye health of students who are compelled to spend night hours in study. The subject of fluorescent lighting, included in this paper, is one of popular interest today.

ASSOCIATED with the consideration of student health is the very important topic of eye health. Because the student is compelled to spend many hours in classrooms, concentrating upon lecture notes, writing boards or quiz papers, and night hours in study under abnormal eye comfort conditions, eye health will always be a division of student health of prime importance.

Approximately 31 per cent of the youth group of college age suffer from near-sightedness and in the productive age group of the faculty (forty to fifty-five years of age), from 70 to 80 per cent have defective vision. (See Figures 1 and 2.) It is apparent that every possible effort should be made to see that the individuals with defective vision have proper adjustments made, and that every effort be made to provide conditions which will reduce eye strain to a minimum.

One of the first recommendations of the illuminating engineer is that the defective vision be corrected to as near normal as is possible under the existing circumstances. The conscientious engineer, when consulted concerning modification of the installation of lighting systems, first warns the client that little which is worth while can be accomplished to relieve those that have defective vision until that condition has been corrected. The illuminating engineer attempts to prescribe a lighting system which will not only prove adequate in quantity of light, but, what is more important, will

* Presented at the meeting of the American Student Health Association, Ann Arbor, Michigan, December 28, 1940. Published simultaneously in the *Proceedings of the American Student Health Association* and the *Journal Lancet.*

have a quality which will produce seeing comfort. It is only because of the efficient and cheap light source which has been developed in the field of electrical engineering that the duty of designing lighting systems and prescribing lighting belongs to this branch of engineering.

The need for an individual who is able to co-ordinate the knowledge of the physician and the engineer is urgent. Progress is being made at this time and it seems that the gap is being filled by a better understanding between the two professions in a common

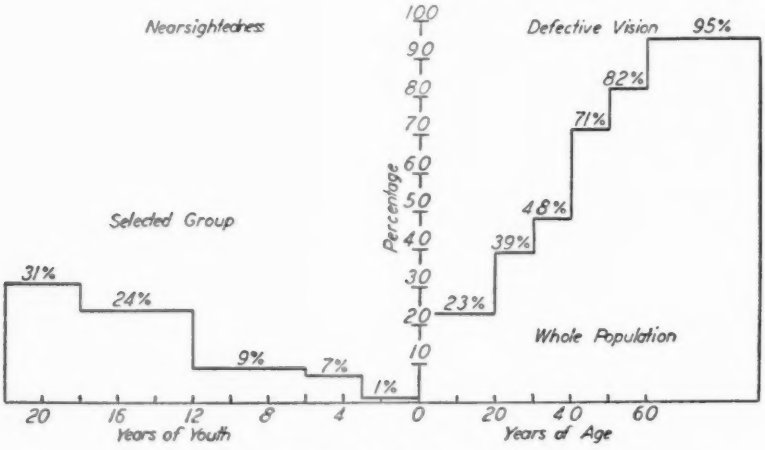

FIG. 1.—Distribution of defective vision with age.

interest and that in the end each will understand the other's vocabularies and function jointly in making recommendations and prescribing lighting. It behooves the illuminating engineer to recommend a testing of the eyes, with accompanying corrections where needed. The physician should insist upon as strain-free seeing conditions as possible so that his prescription shall give the greatest comfort possible.

The lighting of the individual student's study surface has been reduced to practically a package specification, and recommendations are available for school lighting which represent specifications for the minimum desirable conditions for a quantity and quality of

lighting. In the lighting of the school it is impossible to specify a package type of lighting, for there are so many variables which must be considered, as well as the economy of the installation, that it is necessary to study each individual case separately.

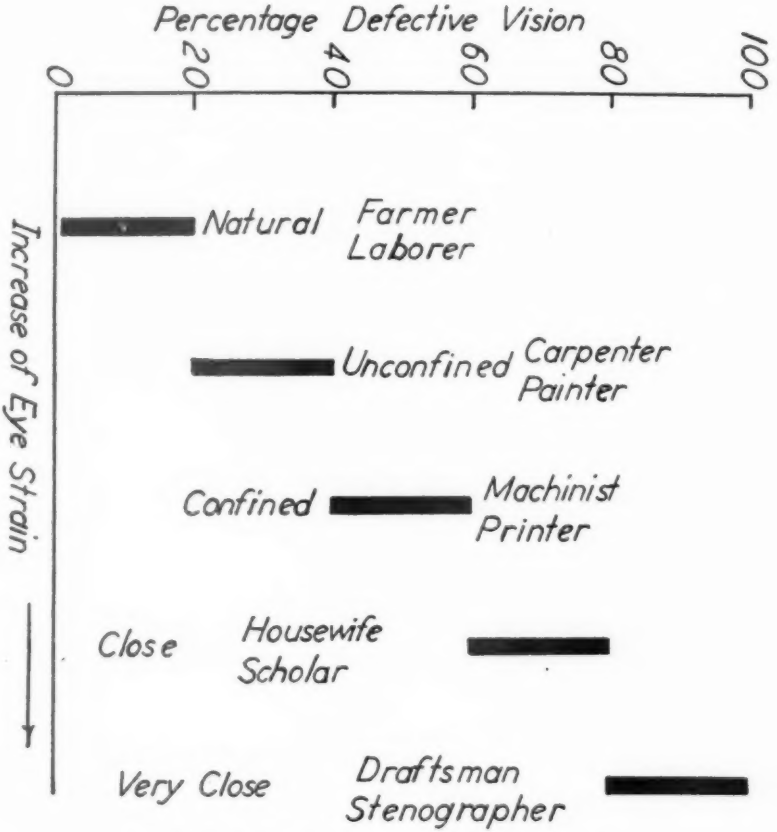

FIG. 2.—Distribution of defective vision with occupation.

Lighting for the College

The *American Recommended Practice of School Lighting*, as sponsored by the Illuminating Engineering Society and approved by

the American Standards Committee,* is the basis for the minimum specifications of school lighting dependent upon the difficulty of the task that must be performed. It is to be understood that this is a minimum specification, not what would be desirable if it were possible to meet the costs of the better installations. Since recommendations for lighting obey a geometrical law, it would be well to double the specifications given if it is desired to obtain a comfortable seeing condition with the attendant lower amount of eyestrain.

The above statement must be considered with an accompanying attention to the conditions of comfort. Unfortunately, so much has been said and written concerning foot-candles that this one unit is often used as the sole basis for a specification. Nothing could be more dangerous. A simple example could be cited by considering an individual reading a newspaper under 10 foot-candles of light. It is possible for the eye to adapt itself to these conditions for a short period of time without serious disturbance. Now, without changing the illumination on the paper, a flashlight beam may be directed into the eyes of the reader with the result that it will be impossible to read the print. The illumination on the paper has remained the same and there has been added to the eye much more illumination, but it has not only been ineffective in producing more comfortable seeing conditions for performing the task, but has actually made it impossible to perform the task. The changing of a lighting system or the specification of a new lighting system must not be undertaken through foot-candle change alone. An increase of foot-candles is desirable if the lighting quality is maintained, but it is meaningless if brightness conditions are such that eyestrain is increased. The term "brightness" must be as fully appreciated as the term "foot-candles" by the interested professions, before worthwhile progress can be made in increasing our foot-candle levels.

Within the range of the eye there must be no sources of excessive brightness nor must there be a brightness contrast of more than ten to one. It would be far better if the ratio were reduced to five to one if possible. Considering these ratios it will be seen that as the general brightness in the room increases the source brightness may also be increased. This fact allows of the specification of the

* *American Recommended Practice of School Lighting*, Illuminating Engineering Society, 51 Madison Avenue, New York City.

brighter fluorescent sources in general lighting as compared to what would be specified with the enclosing glassware using the incandescent lamp. This holds true only where the fluorescent design leads to higher levels of illumination and not where fluorescent installations are used to replace incandescent lamps with the object of saving electrical energy. This new lamp is a tool making it possible to obtain higher levels of illumination with less radiant energy in the form of radiant heat at a wattage specification below that of a corresponding incandescent installation. As will be pointed out later, when dealing with this type of lighting specifically, these gains are not obtained without special financial considerations and without some undesirable features which must be considered upon their merits and not upon the enthusiastic sales arguments of an individual with a catalogue and the fundamental urge of survival in a world of competition for a share of the school administration budget.

Though it has been pointed out before that each problem must be given consideration as an individual lighting task study, the desire of the general public and the school administration group for some yardstick by which to measure, would bring this general recommendation:

Where the classroom is of average size with average ceiling height, and proper coloration (ceiling approximately 75 per cent reflection factor and side walls with a 50 per cent reflection factor as a minimum), six 500-watt lamps properly spaced and controlled with indirect or semi-indirect equipment will give satisfactory lighting for normal classroom work. This work would normally consist of listening to lectures, reciting, making notes, and taking occasional quizzes, with confinement to close work never lasting over periods of an hour. Where the writing boards are used for demonstrations or recitation, there should be special provision for lighting these surfaces.

The above recommendation would not apply to sight-saving classrooms, drafting rooms, sewing rooms, libraries, and other places where the tasks are prolonged and of the type that will produce severe eyestrain if the correct lighting is not installed. The waste of nervous energy through faulty eyesight and poor lighting is probably one of the most important questions for discussion in student health consideration that exists at the present time.

Maintenance

Where lighting is not adequate there are some things that can be done to improve the situation even though it is impossible to install an adequate system. It is understood there is no substitute for the correct lighting system properly installed and maintained, and that

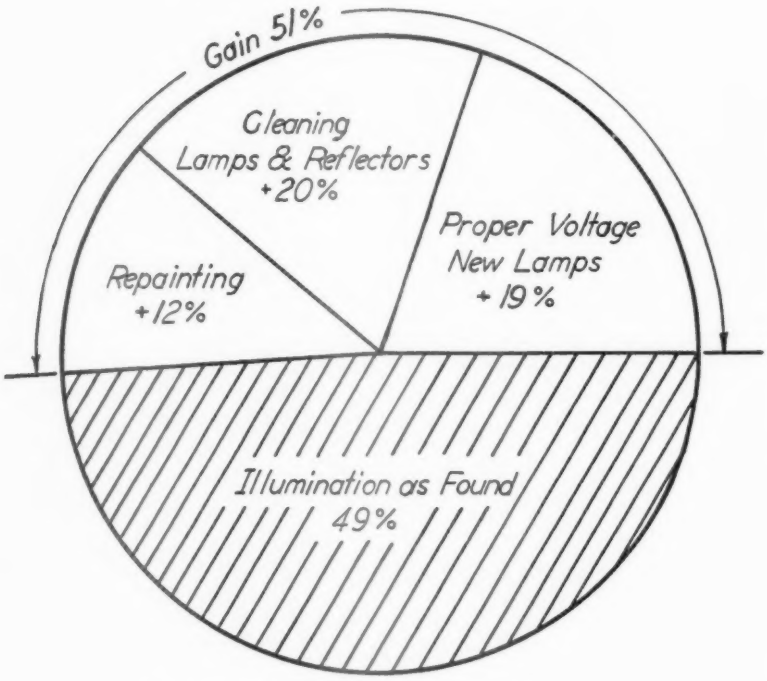

FIG. 3.—Gain in illumination with proper maintenance.

any compromise means merely doing the best that is possible. Though the improvement can not approach the perfect, as it is understood at the present time, there is no reason why any existing system should not be brought up to its highest level of light production. It has been observed that where systems have been improved, giving better lighting, it has always motivated the consideration of the improvement of other localities on the same campus,

and quite often the gain by maintenance has pointed out, in a physical way, the possible advantages of the better standards of lighting.

A net gain of 51 per cent has been shown when repainting, cleaning, and adjusting of lamps and voltage are used for the utmost advantage with the system already installed. (See Figure 3.) Repainting and cleaning should be part of any school maintenance program, and it requires only a judicial adjustment of systematic approach and timing to produce the maximum effect in improving the lighting. It is good economy to burn the proper lamp at the correct socket voltage and there can be some advantage in discarding a lamp before it has operated through its natural life. Though the complete maintenance program has caused an increase of 51 per cent, the result has been to produce more than double the illumination found when the room and lighting system were renovated.

It is frequently found that the wiring capacity is so limited that it is impossible to obtain lamps to operate on the low voltage that exists at the socket, or that the difference in voltage near the source and at the extreme end of the system is so different that a standard lamp placed at these positions would in one instance be over-voltaged while at the other it would be operating at an under-voltage. There is little that can be done for a system of this type except to study the wiring and make such improvements as are necessary.

There are now available smaller wires of higher capacity which may replace the existing wires, allowing a cheaper method of rejuvenating the obsolete system. Another argument being advanced is that the incandescent system may be replaced with fluorescent lamps. For comparable installation, about twice the lumens per watt may be obtained from these newer type lamps; however, where there is a marked deficiency in a wiring system, an improved lighting system, justified in bearing that name, would likewise require additional wiring. Where this is true, the choice of system will again depend upon an economical study of the various systems considered and the consideration of the heat produced by the system; this is particularly true where air conditioning is under consideration.

Lighting for the Critical Task

Roughly, the lighting in the college divides itself into two main types of lighting for seeing tasks. The general lighting has been discussed in a previous paragraph—the next problem to consider is the one for critical seeing. In the drafting room and the sewing room, for instance, a very severe task must be performed and the task is prolonged, for laboratory sections of this type are usually scheduled for three-hour periods. In the library, and at the study surface in the individual rooms, the student may spend hours in close concentration upon poor printing, small type, and his own hurriedly taken notes in the classroom. Each of these tasks will produce, at best, a severe strain upon normal eyes and upon those which have been corrected as close to normal as possible. There should never be a compromise at these work positions; every effort should be made to make them as close to ideal as is economically and technically possible. Except for the student's study desk, there can be no general recommendations given as to what the final installation should be, for each specific case is a study in itself and should be considered by some experienced individual who has in mind both the functional requirements and the special means that are used in accomplishing the results that investigation and practice have shown are satisfactory.

For the student's study surface, there has been developed what may be classed as a package recommendation. It represents the results of studies made by a committee of the Illuminating Engineering Society. The result of this committee's investigations led to the designing of an equipment known under the class specification of the I. E. S. study lamp. This lamp, with the proper bulbs, will provide adequate lighting for study for one individual when it is placed on a table where it can be located to remove the reflected glare in a room of normal student dormitory size. If possible, there should be no compromise on an individual lamp for each student, because of placement and freedom upon the work surface for locating books and writing materials. There have been some suggested arrangements* where it was impossible to finance the requirements for individual lamps for each student, but it must be remembered

* Phelan, Anette M.: "The College Student and Dormitory Study Facilities," the SIGHT-SAVING REVIEW, Vol. IX, No. 1, March, 1939.

that this is a compromise and it was not the intent of the committee making the recommendations that more than one individual should use the lamp. This lamp is not a perfect device, but represents the best that can be obtained within a reasonable cost for the study lamp and its operation. The following is a suggested recommendation which seems to be as satisfactory as can be obtained in a progressive school considering lighting needs of students, which at the same time represents requirements within the economical limits normally presented at the average college:

> The window area, properly shaded, should be at least one-fifth of the floor area. Provisions for study lighting should not depend upon the general room lighting system unless it is of a totally indirect type. Each study position should be properly lighted with an approved lamp requiring a 100-watt incandescent lamp. The quality of work-surface illumination should average between 15 and 25 foot-candles of controlled light, free from both direct and reflected glare. Direct glare is eliminated by properly screening the source; reflected glare, by providing work surfaces with a dull finish. Harsh shadows should not appear on the work surfaces and the illumination should be uniform (10 foot-candles two feet from the lamp center line).
>
> The room surface viewed should have 20 per cent of the work surface illumination, with the reflection factors for the ceiling and sidewalls at 75 and 50 per cent, respectively. The work surface should be at least 30 inches by 42 inches if a desk lamp is used, for it is necessary to locate the lamp properly to remove the reflected glare. For surfaces smaller than this, a floor lamp with filament not less than 60 inches above the floor level should be used in place of a desk lamp. Study lighting equipment should conform to the specifications of the Illuminating Engineering Society (I. E. S.) and should have the required certificate of approval attached when it is purchased.

When making a study of the drafting room, sewing room and library lighting, besides meeting the requirements for a high level of illumination (well-controlled lighting of from 30 to 50 foot-candles), specific attention must be paid to the quality of that lighting. The ideal is a totally indirect system, regardless of the type of light source that is used. Such a system will be free from:

1. Direct glare, if care has been taken in distributing the light over the ceiling surface so as not to produce high brightness contrast or high ceiling brightness.

2. Reflected glare, which will follow the same consideration as direct glare. Reflected glare will never exceed in brightness the initial specular source which produces it.
3. Shadows, which are confusing and cause strain both from brightness contrast and multiple attention points causing confusion in the eye focusing.
4. Non-uniform lighting—the desirability of uniform lighting for a work surface is self-evident but it does not conflict with the atmosphere of interest the architect wishes to create.
5. Differences of brightness between the work and the surroundings. The brightness contrast, as mentioned, should never exceed a ratio of ten to one.
6. Highly polished work surfaces, such as glass tops and varnished desk tops. The tendency is to use dark desk tops and this should be discouraged, for a top with a reflection factor of 20 or 25 per cent will prove more satisfactory, and work on a 30 per cent reflection surface at an illumination of 50 foot-candles is even more satisfactory. It is necessary to reduce the brightness contrast between the book and the surroundings to the limitations set above.

In making recommendations, it must be remembered that a large, low brightness surface may be a source of irritation in itself by producing a glare effect when the student is exposed to the surface for a long period of time.

Fluorescent Lighting

In the preparation of this paper, the author has been asked to consider the latest arrival in the group of light sources—the fluorescent lamp. Much publicity has been given this light source and in many instances this type of lighting is being recommended by individuals with only the most meager knowledge concerning the merits of the equipment in producing a lighting system for comfortable seeing. Often where the adviser recommends such a lighting system he is truthful concerning the statements made and the system when installed and properly maintained will be correct, but he fails to point out the relative cost as compared to the incandescent system, and fails to call attention to the fact that the fluorescent lamp is not as simple and dependable as the incandescent lamp. In producing the fluorescent lamp it is impossible to

obtain the uniformity of quality in color, light production, and life, as in the production of the incandescent lamp.

Where the problem is one of producing a specific color temperature, such as daylight, or the replacement of the old form of tubular light sources, there is little doubt but that with all its inadequacies and some uncertainties, the fluorescent lamp is the correct solution. In the future, in our laboratories, where color is important, and in art classes, it can be expected that daylight or lamps of other color temperatures, or color, will be recommended. Because of the cheapness with which these lamps produce colored light as compared with other methods, the added inconvenience need not be given serious consideration. The result justifies the extra expenditure for auxiliary equipment and the special operating and maintenance problems which the fluorescent source introduces.

The specification of fluorescent lighting for general illumination in the libraries and classrooms of the college, and, as has sometimes been recommended, for the dormitories, should be given detailed consideration with a complete study of the economics involved. Today the installations of this type are much more justified than they were a year ago; in fact, it has been shown by reliable lamp manufacturers that from March, 1939, to March, 1940, a basic unit of fluorescent lighting when installed has been reduced in cost from $6.71 to $3.77, which is a reduction of 44 per cent, based on the 1939 standard. The word "unit" includes the complete cost of lamp, auxiliaries, and equipment, with due consideration of the time interval of burning during lamp life.

In the following statements it may be that some will conclude that the author is opposed to the installation of fluorescent lighting in the college, but this is not the case. The author has in several instances recommended this type of lighting in colleges, but only where the conditions justified the recommendation, and it was pointed out to the client that the economical justification would be accompanied with several other difficulties which are not present in an incandescent lighting system. As the lamp is developed and perfection is approached, as the cost of the lamp and auxiliary is reduced, there will be more reason for making recommendations for installations of fluorescent lighting to meet general lighting needs. Where a school is considering air-conditioning in particular, to meet

the heat problem during summer school periods, it is recommended that considerable attention be given the fluorescent lamp.

The desire of the illuminating engineer is for more illumination, and since a good portion of the energy which is delivered at the light source produces heat, his intentions are antagonistic to those of the ventilating engineer, who wishes to exclude all possible foreign heat. In rooms to be air-conditioned it is necessary to have the co-operation of the groups interested if the lighting requirements are not to suffer.

There are two general rules that seem to prove true in most cases: it is not satisfactory to replace incandescent lighting by equipment which will give the existing foot-candles; and it is seldom possible to replace incandescent lamps, watt for watt, with fluorescent lamps and obtain the lighting benefits which the new source makes possible. Therefore, since a good installation of fluorescent light should in the usual case require some rewiring, it is well, in making the study for recommendations in lighting improvement, to balance the cost of this type of lighting against the cost of an incandescent system.

Since the usual sales approach for fluorescent lighting is that more light is obtained from the same wattage, and this is true, the following questions are raised: "Does this mean more lighting for the dollars invested, and does it mean a system which will be satisfactory from the operation and maintenance standpoint?"

To answer this question it is necessary to consider somewhat unrelated factors, which are listed below:

1. Is Daylight Quality of Light Necessary?—Reports on the effect of color in light when considering daylight color temperature or even monochromatic light, have shown that there is no appreciable effect on the subject, regardless of the color of the light within the limits of illumination levels normally recommended for interior lighting. There are some psychological effects caused by the monochromatic lights of various colors, but there seems to be a rapid adaptation by the individual to the colored light if there are no other light sources which can be used for comparison.

2. Are There Factors Which Might Discount the Reports of Unusual Gains in Foot-Candles?—Where a reported installation shows a gain in illumination of more than double after replacement of an

incandescent system by fluorescent lighting, there are grounds for questions. If, at the time of making the new installation, the wattage has been increased, the room has been reconditioned, and the lamps adjusted to the voltage, the gains through these changes cannot be credited as an advantage of the new light source.

During the first 100 hours of burning of the fluorescent lamp there is an increase in the lumen output of the lamp which does not represent the actual average conditions that exist during the life of the lamp. Any reported improvement should be on measurements made after the lamp has been in operation at least a minimum of 100 hours.

The type of foot-candle meter used may be of importance. The use of the barrier-layer cell in making light measurements will introduce an error in the report of true illumination gain, for this instrument is calibrated under a specific color temperature and some of the fluorescent lamps have different color temperatures or are off the black-body curve completely, which may cause the meter to read high unless it has a correction filter adjusting the meter reading to the true eye response curve.

3. Is the Fluorescent Source of Low Brightness?—Compared with the incandescent lamps of 300 and 500 watts, which are usually used for general lighting in colleges, the fluorescent lamp is of relatively low brightness. However, comparing the brightness of the fluorescent lamp with that of the desirable brightness of the lighting equipment used in classrooms is another matter, for in this instance the fluorescent lamp is much the brighter. It is not desirable to install a lighting system using fluorescent lamps in the classroom where the eye is exposed to either the direct or the reflected glare from the lamp. The source brightness of the fluorescent lamp exceeds that recommended in the *American Recommended Practice of School Lighting*, which was established for the minimum foot-candles listed in these recommendations. The information which is available indicates that if the illumination is increased the source brightness may be increased, and a study of these principles may bring recommendations giving a foot-candle brightness specification instead of a fixed brightness value. However, it would be well to follow the recommendations for brightness values in schools until such a time as the Illuminating Engineering Society, through

its committee, recommends otherwise. This brightness limitation does not preclude the use of fluorescent lamps but does limit the type of equipment which may be installed and definitely excludes the placing of bare fluorescent lamps in any room which is being used for class or laboratory purposes.

4. Is the Fluorescent Installation More Complicated Than an Incandescent Lamp Installation?—There are current flow limiting devices, power factor correction principles, automatic switching and proper starting compensation provisions made in the fluorescent system, while the incandescent system is entirely free from any of the above mentioned auxiliary equipment. (See Figure 4.) The whole fluorescent arrangement is a balanced system depending on adjusted parts, and is more sensitive to voltage regulation and temperature for perfect operation. In the incandescent system, improper voltage regulation means uneconomical and inefficient operation but does not preclude operation, while with the fluorescent lamp these same conditions not only cause the same effect on economy of operation, but may cause deterioration of the system and even preclude operation when carried to certain probable occurring limits.

5. Is There a Hum?—There will be a hum from the auxiliaries because, to date, the electrical engineer has not been able to design a ballast composed of iron and copper which will not hum. Is the hum objectionable? The answer to this question depends upon the reaction of the individual. If the units are built by a reliable manufacturer and are properly cushioned, it may be said, in general, that the level of hum is so low that the average individual will accept it as a background noise and will not be conscious of its presence.

If it is necessary to remove this hum completely, it is possible to locate the ballasts outside of the room or at some central location, in sound-proof cabinets. This item must be considered in a design, for the location of the auxiliary equipment at points removed from the lamps requires more wire and a cabinet, both of which will increase the cost.

Where the teacher might be an individual irritated by the hum, there is a possibility of having the advantage of the lighting system nullified. If the teacher is irritated by the hum, it is natural that the cause would be removed by turning out the lights, which de-

feats the whole purpose of the lighting design. Regardless of how well a classroom is designed, there is a need on the brightest day for

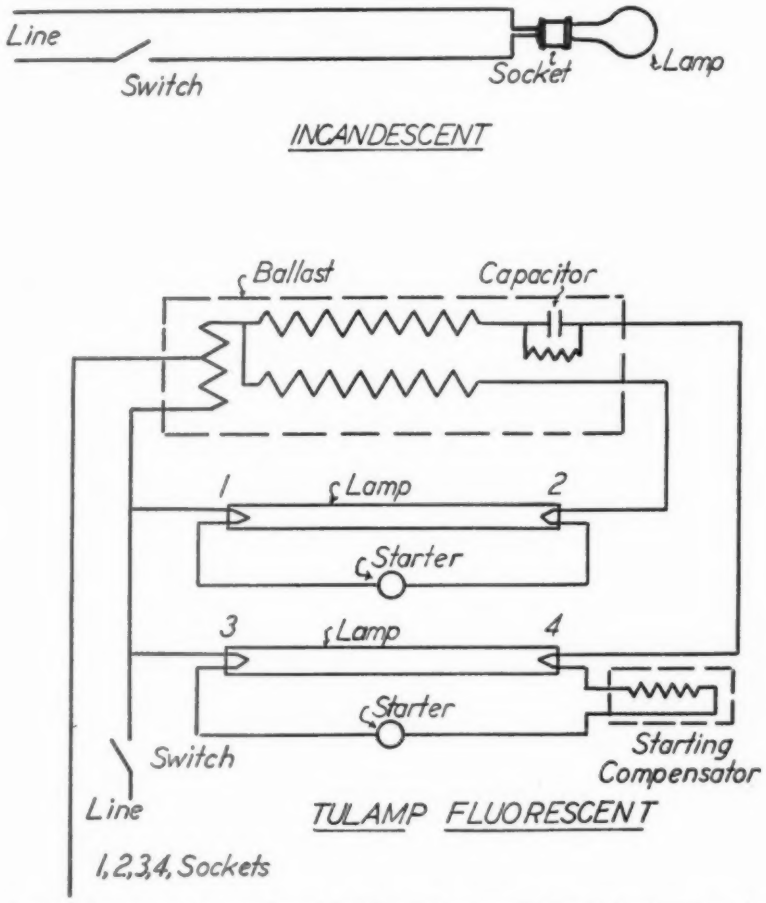

FIG. 4.—Comparing the incandescent and tulamp fluorescent lamp with reference to the complicacy of the auxiliary equipment.

artificial lighting at the inner row of seats farthest removed from the windows, and on a dull day it will be necessary to light the room completely with artificial lighting.

6. Is There a Different Maintenance Problem for Fluorescent Lamps?—The problem of care of the system is quite different. The incandescent lamp either functions or does not function, and even if the lamp does not burn, no damage is done by having the switch at the *on* position. The incandescent lamp lights immediately without a delay period and burns at what seems to the eye to be a uniform brightness.

The same is not true for the fluorescent lamp. It does not start immediately when the switch is placed in the *on* position. There is a period of preparation which the lamp passes through, and during this relatively short period there may be some flicker. If the lamp or its auxiliaries do not operate correctly, there is a likelihood of damage to the lamp or the auxiliaries, and the failure to function with the switch in the *on* position may cause an expensive renewal unless the lamp is either cut off or immediately serviced. The first defeats the purpose for which the lighting system was installed, and the latter is very difficult to obtain in the college or university.

There is another effect in which the gas in the lamps seems to be swirling. Though the lamp is operating at normal brightness, the effect is the same as a flicker to the eye and will cause enough irritation to make it necessary to turn off the lights. It has been found that, because of habit, some individuals accustomed to the quick action of the incandescent lamp, are extremely annoyed by the initial flicker when the lamps are starting.

7. What of Stroboscopic Effect?—The first lamps were operated as single units from single phase electric lines. Since the gas conduction causing the glow in the tube follows the change in current which passes twice through zero in a cycle, there is a definite extinguishing of the lamp. The same occurs in the incandescent lamp, but there is enough delay in the cooling of the filament that the eye carries over. The rapid and positive breaking of the continuity of light makes it possible to obtain several separate and distinct images of any moving object. This multiple image formation is very objectionable to one inclined to be even slightly nervous. Because of the early lamps, the fluorescent lamp still carries the stigma of a first development. It is the practice today to install what is known as a *tulamp* unit, using two fluorescent lamps correctly connected so that the resultant effect is no more severe than

that found with the incandescent. There are also many single lamp installations that are giving very satisfactory service. To make sure that there will be no unnecessary objection to the system, it is well to forestall stroboscopic effects by using the latest lamp and auxiliary arrangements.

8. Will the Fluorescent Lamp Give More Light for the Same Wattage?—The fluorescent lamp will give more lumens per watt than will the incandescent lamp, but not as much as is frequently credited to the lamp. It is fair and correct, when calculating the lumen output per watt for the lamp, to include with the lamp wattage the wattage of the auxiliary equipment.

For general incandescent lighting the 300-watt and the 500-watt lamps represent the normal capacity that should be installed in designing proper school lighting. The table below compares the incandescent and fluorescent lamps:

Incandescent		
300-w	5,900 lumens	19.7 lumens per watt
500-w	10,000 lumens	20.0 lumens per watt
White Fluorescent (Tulamp, 115 volts, including auxiliary loss)		
40-w	2,100 lumens	36.5 lumens per watt
Daylight Fluorescent (Tulamp, 115 volts, including auxiliary loss)		
40-w	1,800 lumens	31.4 lumens per watt

The values given are from recent publications, but as the lamp is being improved there is an increase of efficiency. To replace the 500-watt lamp will take approximately five white fluorescent lamps, which, with the auxiliaries, represent about 243 watts, or approximately half the wattage accompanied by a doubling of the lumens per watt. This gain is very much reduced on a dollar base when comparing the initial installation costs. It is this gain of light with less wattage which makes it mandatory that fluorescent systems be given consideration when designing or remodelling lighting for schools.

By installing a 230-volt system it would be possible to increase the capacity of the lighting system and improve the efficiency of the fluorescent system a few per cent more. In making any study of this new light source all computations should be made on the

latest published data, for the development of these sources is progressing so rapidly that data become obsolete very rapidly.

The most recent lamp size added to this group is the 100-watt lamp, which has approximately the same lumens per watt output as the 40-watt lamp, but the total output is such that the number of lamps needed is reduced and the fixture costs will be reduced because fewer will be needed.

It is essential that the one specifying or requesting this new form of light source be informed about the above features when considering the lighting system. It is not logical to know only a portion of the story and try to draw conclusions from this limited information. The well-designed fluorescent lamp system can give the same quality of lighting as can the well-designed incandescent system. The fluorescent lamp has the advantage of giving considerably more light for the same wattage, with some very undesirable operating conditions. In making a choice, all the factors involved must be evaluated, and this is difficult because part of the problem deals with subjective factors rather than with the objective ones which may be definitely evaluated. Experience with some of the installations now in service and being installed will permit of a more accurate evaluation of the subjective factors.

It may be of interest to consider the use of auxiliary fluorescent lamps in a library. (See Figure 5.) The general illumination is approximately 20 per cent of the table illumination. One room uses a well-controlled direct system of general lighting, the other a semi-indirect system. Both of these installations have the approval of the library staff and the students. At best, this type of lighting is a makeshift because it was necessary to increase the work surface illumination and it was impossible to supply adequate general lighting of the correct quality. A table type of library lighting should never be installed in planning a new building. Correct library lighting is a comfortable system of general lighting which will give adequate illumination.

Summary

The question of eye health in the college is so closely linked with the lighting of the task which must be performed that it is impossible to separate the two. The professions interested in the correct

(*a*) In conjunction with direct lighting

(*b*) In conjunction with semi-indirect lighting

FIG. 5.—Table Type Fluorescent Lamps for Library Service.

solution of the lighting requirements are perforce of very different training and point of view. To obtain data to determine the satisfactory type of lighting and amount of illumination will require the co-operation of both the medical and engineering professions. This co-operation must be built upon the mutual respect of each profession for the ability of the other, and a maturing of each profession in the requirements which must and can be met in specifying a lighting installation. When this has been accomplished and both professions place their proven claims before the college administration, the group responsible for the operation and policy of the college will have to give more attention to the sadly neglected problem of providing adequate and correct functional lighting where study and laboratory work is the daily and nightly task.

There is another group of individuals—architects—who must be considered and who may prove a major hindrance if their problems are not considered and their co-operation sought. This group is trained in producing the desirable atmosphere with the materials at hand and this is often a very difficult task when funds are limited. It will be found that proper sympathy with the solutions of their problem will permit of a fitting of a lighting design into the atmosphere sought by the architect without either group having to make more than minor adjustments in their original ideas.

It is essential that these professions agree upon methods of procedure and upon what will be a pleasant and satisfactory lighting system, and if they will co-operate in educating the student to demand good lighting and in educating the administration to the necessity for good lighting, there will soon be considerable impetus to a movement which has slowly been gaining momentum and which has grown under a slogan which combines better sight with better lighting.

Facts and Factors in the Prevention of Blindness Program*

C. Edith Kerby

WHAT is blindness; how prevalent is it; how much defective vision is there; what are the larger aspects of conservation of vision; and whose responsibility is it to prevent blindness and conserve sight? These are some of the questions answered by Miss Kerby.

THE problems of welfare work with the blind and the work for prevention of blindness and sight conservation differ in so many respects that it is usually desirable for the two programs to be organized separately and carried on with their own highly specialized personnel. For example, the blind and the partially-seeing require special but quite different educational methods. The chief distinction between the two groups is that the blind, who are presumed to have little or no useful vision, must rely on other senses, usually the tactual sense, in acquiring knowledge and skills; while the partially-seeing, whose chief need is conservation of vision, use visual methods but require special materials and environment to compensate for their handicap.

Definitions of Blindness and Seriously Defective Vision

Definitions of blindness vary somewhat in different states and sometimes even within a state administering programs for the blind under more than one agency. However, the one in most general use for purposes of compensation and financial assistance is "economic blindness." This defines a blind person as one who, with eyeglass correction, has central visual acuity of 20/200 or less in the better eye, or one who has better than 20/200 central vision but an equivalent handicap due to limitation of peripheral vision (usually

* Excerpted, with permission, from the article on "Blindness and Conservation of Sight," written jointly with Evelyn C. McKay, and published in the *Social Work Year Book, 1941.*

to a diameter of 20° or less). This means that the person on the borderline of blindness can just recognize at a given distance detail which a person with normal vision can see at ten times that distance. While he might read capital letters in approximately 18-point type, he would experience as much difficulty as the person with normal vision would in reading 2-point type. If the defect is in peripheral vision, his entire field of vision in the better eye would be less than the size of an ordinary book page at reading distance, and not much larger than the height of a tall man at a distance of 20 feet.

The partially-seeing group includes those having corrected visual acuity between 20/200 and 20/70, as well as those with less marked defects whose vision may grow progressively worse.

Prevalence and Causes of Blindness and Defective Vision

State-wide surveys and statistics showing the number of persons on blind assistance rolls give a better basis for estimating the number of blind persons than existing census data. The best estimates available place the figure for the number of blind as defined above in the United States somewhere between 200,000 and 250,000, or approximately 1.5 to 2.0 per 1,000 of the general population. The number of partially-seeing is probably higher. It has been found to be about 2 per 1,000 in the school-age group.

Moderate or slight degrees of deviation from normal vision are quite common in the population at all ages and all economic levels. Estimates of their prevalence by type and by degree are impractical because experts find it difficult to define a "defect," inasmuch as the need for correction depends so largely upon the individual's tolerance of his defect.

A series of studies of causes of blindness inaugurated by the Committee on Statistics of the Blind* in 1933 is supplying more

* The Committee on Statistics of the Blind, jointly sponsored by the American Foundation for the Blind and the National Society for the Prevention of Blindness, was appointed in 1929 to study the problems of statistics of blindness and the blind and make recommendations for the improvement of such statistical data. Its membership consists of: Dr. Ralph G. Hurlin, Russell Sage Foundation, Chairman; Dr. Conrad Berens, New York Eye and Ear Infirmary; Dr. Lewis H. Carris and Miss C. Edith Kerby, National Society for the Prevention of Blindness; Mr. Robert B. Irwin and Miss Evelyn C. McKay, American Foundation for the Blind; Mr. Bennet Mead, formerly of the U. S. Bureau of Census; Dr. B. Franklin Royer; Mr. Stetson K. Ryan, Connecticut Board of Education of the Blind. Office of the Secretary, 15 West 16th Street, New York, N. Y.

adequate statistics than had previously been available. These studies, which follow the Standard Classification of Causes of Blindness developed by the Committee, provide similar data for all groups studied, making possible comparisons and combinations of the figures. They also fill the need for information regarding the underlying causes of blindness, so necessary in formulating prevention programs.

Cause-of-blindness data in which the etiological factors have been cross-classified with the type and site of eye affections are available at present for more than two-thirds of the blind of school age* and for groups of adult recipients of blind assistance in several states.† While these samples are not representative of the entire blind population, they indicate the major problems in prevention of blindness. The most important findings to date are the following:

1. The need for intensive research into etiological factors, shown in the lack of such information on records of blind persons examined long after blindness occurred and of those whose blindness was caused by eye conditions, such as cataract and glaucoma, the etiologies of which are unknown. Among children, cases which fall in the "unknown" categories are the 36 per cent of "prenatal origin, cause not specified"; the 10 per cent classified as "undetermined by physician"; and 3 per cent "unknown to science"—a total of 49 per cent in all. Among adult recipients of aid to the blind, the corresponding figures are, approximately, 8 per cent of "prenatal origin, cause not specified"; 16 per cent "undetermined by physician"; and 30 per cent "unknown to science"—a total of 54 per cent.
2. The fact that one-fourth of blindness (24 per cent in children and 23 per cent in adults) is caused by "infectious diseases." The true figure may be considerably higher. In the order of their numerical importance the communicable diseases most likely to cause blindness are syphilis, ophthalmia neonatorum (babies' sore eyes), trachoma, meningitis, and gonorrheal eye infections.
3. Accidents, both occupational and non-occupational, are the cause of 9 per cent of blindness in children and 13 per cent

* See Committee on Statistics of the Blind, *infra cit.*

† The Social Security Board has adopted the Standard Classification of Causes of Blindness for use by agencies administering aid to the blind programs. See *Social Security Board, Instructions to State Agencies Participating in the Study of Causes of Blindness Among Recipients of Aid to the Blind* (*infra cit.*).

in adults. (The percentage for adults is undoubtedly higher, since those receiving compensation for occupational injuries are not included.)

4. Heredity is responsible for a considerable amount of blindness. It is an established factor in 2 per cent of blindness among children and adults; is presumed to be present in at least an additional 11 per cent of blindness among children; and may be the causal factor in many additional cases among both children and adults whose family histories have not been investigated.
5. Other significant causes of blindness are such "general diseases" as diabetes, nephritis, and diseases of the vascular or nervous systems, which account for 2 per cent of blindness among children and 6 per cent among adults; "neoplasms" (tumors), which account for 3 per cent of blindness among children and 1 per cent among adults; and "poisoning," which accounts for 1 per cent of blindness among adults.

Causes of eye difficulty among the partially-seeing are similar in nature but somewhat different in distribution. For example, there are proportionately many more cases of refractive errors, chiefly high myopia, which cannot be corrected to normal with glasses or which are progressive in nature.

Prevention of Blindness

The program of prevention utilizes a variety of methods and leadership. For convenience, these will be presented separately.

Obviously, the emphasis in prevention programs should be on elimination of underlying causes of blindness. However, when the etiology is unknown, the immediate objective must be treatment for arrest or correction of the eye lesion itself. Two such conditions, unfortunately, are among the major causes of loss of vision:

1. Cataract, in which by needling or removal of the opaque crystalline lens in the eye and provision of glasses, the patient may be given good vision.
2. Glaucoma, in which, if diagnosis is made in the early stages and the patient continues under ophthalmological supervision, useful central and peripheral vision may be retained throughout life.

Infectious diseases, which have taken a large toll of eyes, can be prevented at the source by control of their spread, or be adequately treated to prevent disastrous sequelae. Communicable disease control measures include necessary legislation, such as required use of prophylactics in the eyes of the newborn, and compulsory premarital and prenatal examination and treatment for syphilis. Venereal disease control may play as spectacular a role in prevention of blindness as compulsory vaccination, which has made blindness from smallpox practically a thing of the past.

Discovery of the new drug, sulfanilamide, which has been demonstrated as a cure for trachoma, provides a new and effective weapon in the age-long war on this disease.

Similarly, improved and new techniques in eye surgery now make possible re-attachment of a separated retina, and replacement of an opaque cornea with clear tissue from another eye.

Control of hereditary blindness is gradually being accomplished by enlisting the co-operation of those in whom serious anomalies of eye structure are proved hereditary.

Safety education and other measures for elimination of eye injuries in industry, home, etc., have proved effective, particularly when supplemented by legislation, as in laws prohibiting sale and use of fireworks and air rifles, codes specifying safety equipment in industry, etc.

More and more individuals considered blind are being removed from this category by the route of adequate ophthalmological examination, followed by medical, surgical or even mechanical (eyeglass) correction. In fact, the correction and prevention programs of some state welfare departments have developed as a result of the need discovered in examining applicants for aid to the blind.

Maintenance of general health and nutrition is beginning to be appreciated as the ounce of prevention which may protect the eyes from disaster.

Conservation of Vision

Special education to conserve the vision of individuals who without proper safeguards might become blind, or of those with vision so low as to require special materials, can be provided in the public schools in so-called sight-saving classes, of which there are now

605 located in 29 states. In these classes large-type books and typewriters, maps in bold outline without detail, pencils, pens, and crayons that produce broad lines, etc., are used. Also, the specially trained teacher adapts the work of the regular grades to the needs of her pupils by permitting them to take their places in the regular classrooms only during periods when no close work is required; even in the well-lighted sight-saving classroom she shortens the periods of eye work and substitutes eye-saving materials and methods whenever possible.*

High school education, either in special classes or in regular classes with the aid of a reader, and special vocational testing, guidance, and training are recognized needs of this group, but such facilities are not generally available.

To be adequate, conservation of vision of the children in regular grades, as well as of younger children, should include methods and materials to assure eye comfort and efficiency of the students during the educational process, adequate service for detection of visual defects, community facilities for their correction, and proper school and home lighting. It is recognized that these objectives will not be reached until the basic training of teachers and nurses includes more adequate eye health knowledge.

Prevention of Blindness Agencies and Personnel

In organizing a prevention of blindness and sight conservation program, the objective should be to integrate eye care into the broad general programs of existing official and voluntary agencies in the community responsible for health, welfare, education, safety, etc. The function of a prevention of blindness agency, therefore, is to stimulate and co-ordinate such efforts. To illustrate: state and local health officers are responsible for enforcing laws requiring use of prophylactic drops in the eyes of the newborn, and for seeing that cases of ophthalmia neonatorum are reported, and adequate medical and nursing care provided in each such case; but the stimulation of these measures in all states has been part of the program of the National Society for the Prevention of Blindness. Similarly, school authorities are responsible for setting up, financing and supervising sight-saving classes; but public education to show the

* See Cohen, *infra cit.*

need for such classes, as well as demonstration of proper training for sight-saving class teachers, is also part of the National Society's program.

State voluntary agencies function in much the same way, although in connection with certain activities they may carry more responsibility for details. When a state agency is set up as a division of an official state department, such as the department of welfare, it may function only in the general area of activity of that department, or it may associate itself with a co-ordinating group representing all other official departments and voluntary agencies concerned and thus enlarge the scope of the program.*

Because of the broad nature of the program for sight conservation and the prevention of blindness, leadership and responsibility must be shared by many professional groups. To prepare these groups adequately for work in this specialized field, the National Society has helped appropriate educational centers to organize and finance courses for sight-saving class teachers and supervisors, for medical social eye workers, and for health educators in teacher training institutions. Short in-service-training institutes for public health nurses and others have also been conducted. As part of its educational service, the Society maintains a reservoir of the materials needed by prevention workers, including periodicals, pamphlets, films, exhibits, and vision-testing charts, and gives advisory service in the field and through correspondence.

Ophthalmologists working in private offices, operating rooms and out-patient departments have provided the medical care which is basic in prevention of blindness programs. They are further participating by serving as supervising ophthalmologists and examiners in state programs for aid to the blind, as advisers to departments carrying prevention of blindness programs, and as examiners and treatment specialists in services organized for trachoma patients, as well as for those in rural areas. In addition, through conservation of vision committees of state and county medical societies, this group is making a valuable contribution to public education.

* Because of the rapid growth in the number of agencies having responsibility for various parts of the program any list must be incomplete. Inquiries as to resources in any region may be addressed to the National Society for the Prevention of Blindness.

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A Digest of Problems of Vision Testing for Screening Purposes*

Eleanor W. Mumford, R.N.

The REVIEW introduces in this issue the first of a series of digests on problems of vision testing for screening purposes. The material, presented by Miss Mumford, is not inclusive but represents a selection reviewed by one of the Society's committees, of which she is a member, which has been studying problems of screening for eye conditions. The selection does not indicate that the committee either accepts or rejects the methods or conclusions of the studies digested, but rather that each study has some bearing upon the consideration of problems of vision testing for screening purposes.

THIS is the first installment of a series of abstracts of published material relating to "screening procedures" used by health agencies in discovering individuals to refer for a thorough eye examination because of suspected eye defects or disease. This project was undertaken because of wide interest on the part of health workers and a healthy dissatisfaction with present methods, and because much of the material included is not readily available to workers and administrators responsible for screening procedures.†

The series will include studies of visual functioning or of vision testing methods—the latter from the point of view of their use by health workers for screening purposes. As far as possible the former will be so presented as to indicate the tests and techniques used and the criteria for classification of defects or disease. Effort has

* See page 54, editorial by Dr. Thomas H. Johnson, chairman of the Committee on Vision Testing Procedures. In an early issue Miss Mumford will discuss problems involved in screening for eye conditions.

† Two mimeographed bulletins on screening for eye defects are available on request from the National Society for the Prevention of Blindness: "Recommendations Concerning the Purposes of Screening for Eye Difficulties," and "Eye Inspection and Vision Testing."

been made to follow a uniform pattern to make the data in both types of studies as comparable as possible, selecting such items from the studies as seem pertinent to screening problems. Since some are far more complete than others, footnotes and parentheses have been used to call attention to certain gaps which affect comparability of data, results, or procedures. In some of the studies certain items which seem important are covered by general statements which do not lend themselves to exactness in abstracting. Where this is true, the original statement is quoted. Quotations are also used to emphasize statements of observation or from previous experience of investigators which seem to have important bearing upon screening practices. These abstracts will be followed by briefer digests of data relating to the scientific bases of tests used in screening procedures and factors influencing results.

The Eyesight of the School Child as Determined by the Snellen Test. S. D. Collins. *Public Health Reports*, vol. 39, no. 48, Nov. 28, 1924, pp. 3013–3027.

PURPOSE OF STUDY

To determine the visual acuity as indicated by the Snellen test and to analyze statistically the incidence of defective vision by age and sex.

GROUP STUDIED

Approximately 12,000 children (6–16 years of age) in eastern states from New York to South Carolina, mostly in rural schools.

TESTS AND TECHNIQUES EMPLOYED

Snellen: At 20 feet; illumination not specified; illiterate chart for children who could not read—type of illiterate chart not specified.

METHODS OF CONDUCTING STUDY

Tests made by United States Public Health Service as part of general physical examination. The cases were classified in 10 groups according to visual acuity.

FINDINGS

1. Children 6–16 years of age who had
   a. Normal visual acuity* in both eyes (20/20 or better) . 62.9%
   b. 20/25 or 20/30 in one and 20/30 or better in the other eye 27.1%
   c. 20/40 or 20/50 in one and 20/50 or better in the other eye 6.1%
   d. 20/70 or less in one or both eyes 3.9%

* Visual acuity in this study is expressed as a fraction in tenths, a table being presented to translate these fractions into the usual Snellen fractions which are used in the digest.

2. Children with 20/70 or less in both eyes..... 1.6%
3. Sex as a factor:
   a. Normal vision: in higher percentage of boys than girls.
   b. Poor vision: percentage about equal in both sexes.
4. Age factors:
   a. Percentage with normal vision in both eyes (20/20 or better) rose with age (6–16 years).
   b. Percentage with better than 20/20 vision in both eyes rose with age while percentage with just 20/20 vision in both eyes decreased.
   c. Percentage with slight defects decreased with age while percentage with serious defects increased with age.
5. Vision of right and left eye classified separately:
   Vision in each eye shows the same general tendency as to age and sex as already described for the two eyes combined.
6. Correlation between vision of right and left eye:
   a. Of children with normal vision in one eye, 91.3 per cent had normal vision in the other.
   b. Of children with defective vision, the percentage of those who had the same vision in the left as in the right eye was much larger than the percentage of those who had other degrees of defect. However, there seemed to be a greater tendency for equal vision in both eyes among children with better vision than among those with poorer vision and this tendency to unequal vision was more common in children with seriously defective vision.

Variation in Eyesight at Different Ages, as Determined by the Snellen Test. S. D. Collins and R. H. Britten. Reprint No. 979 from the *Public Health Reports*, Dec. 19, 1924, pp. 3189–3194.

PURPOSE OF STUDY

A comparison of visual acuity of school children and of adult workers.

GROUP STUDIED

4,862 native white boys 6–16+ years of age and 6,479 male white industrial workers chiefly over 18 years of age.*

TESTS AND TECHNIQUES EMPLOYED

Snellen: Illiterate (type not specified) and lines of letters. (Techniques reported on in previous studies.)

METHODS OF CONDUCTING STUDY

Tabulation of previous studies.

* Vision of both groups has been reported on more extensively in previous reports. See preceding digest and "Standards of Measurement of Ten Thousand Male Workers: Preliminary Note, with Special Reference to Racial Factors," L. R. Thompson and Rollo H. Britten. *Am. Jour. of Pub. Health*, Vol. XIV, no. 5, pp. 383–390, May, 1924.

FINDINGS

1. Normal vision (20/20 or better in both eyes): The percentage classed as normal increased with age from 57 per cent at 6 years to 77 per cent at 20, then declined, and of the group over 60, only 5 per cent were classified as normal.
2. Moderately defective (20/40 or 20/30 one eye and 20/40 or better in the other): The percentage in this class decreased during the school years but rose from 20 to 50 years, then again declined. Apparently during the school years some shift into the normal group, others to the markedly defective group, but after 50 many who were previously classed as having moderate defects develop more serious ones.
3. Markedly defective (20/50 or less in one or both eyes): The percentage in this group rose steadily from 6 years of age and most rapidly after 45. Up to 40 years of age only 15 per cent were in this group, but at 65 years, 70 per cent were classed thus. The rate of increase was more rapid in school age children than in the adults under 45.

Vision Survey Among a Group of Pupils of Syracuse Schools. H. H. Levy, M.D. *American Journal of Public Health*, Vol. XVIII, no. 10, Oct., 1928, pp. 1273–1281.

PURPOSE OF STUDY

To determine age at which school children's vision should be tested, desirable methods, ability of school physician to detect defects.

GROUP STUDIED

4,060 school children 5–17 years, varied nationality and economic status.

TESTS AND TECHNIQUES EMPLOYED

1. *Snellen* (Symbol E for illiterates): Distance 20 feet; "illuminated by direct light greater than 10 foot-candles"; later the chart was mounted on a board to which was affixed a student-lamp-type of illumination with a 50-candle-power frosted bulb.*

2. *Ives apparatus.*

3. *Inspection* of lids (everted), pupillary reflexes, cornea, fundus, muscle balance (method of testing not specified).

4. *History and symptoms.*

METHODS OF CONDUCTING STUDY (Very little detail given).

1. After 1,499 children had been tested with both Ives and Snellen, correlation was found close and Ives was eliminated as less satisfactory.

2. Routed to family physician or oculist "those with 20/40 or less and those with better than 20/40 who had other symptoms."

* The intensity of illumination with this apparatus is not indicated.

FINDINGS

1. Ives apparatus unsatisfactory, subjective, not suitable in first and second grade, not easily transported, expensive.
2. Of 4,060 children, 3,910 were hyperopic, 142 myopic, 8 had mixed astigmatism, 63 strabismus.* Of the entire group, 16 per cent were referred for refraction, 9.5 per cent because of low visual acuity, 6.7 per cent because of other symptoms (not listed in detail but classed as "asthenopia").
3. Percentage of children routed for refraction was lowest among 5 and 6 year olds (roughly 8 per cent of each group), rose to 25 per cent of the 15 year olds. By grades the highest percentage of referrals (23 per cent) was in the seventh grade, except for the deaf and ungraded classes where referrals were approximately 30 per cent of the groups.
4. The percentage of those who had failed one or more grades was higher for those with defective vision (39 per cent boys, 34 per cent girls) than for those with normal vision (34 and 25 per cent respectively for boys and girls).

Refractive Errors in the Eyes of Children as Determined by Retinoscopic Examination with a Cycloplegic. Results of Eye Examinations of 1,860 White School Children in Washington, D. C. G. A. Kempf, M.D., S. D. Collins, and B. L. Jarman, M.D. *Public Health Bulletin*, no. 182, Dec., 1928. United States Public Health Service, Washington, D. C.

PURPOSE OF STUDY

To determine prevalence and degree of refractive errors at various ages.

GROUP STUDIED

1,860 unselected white school children of Washington, D. C., 6 to 14 years of age.

TESTS AND TECHNIQUES EMPLOYED

1. *Snellen test:* artificial illumination "always as high as 20 foot-candles on darkest part of chart."† (With and without cycloplegia.)
2. *Retinoscopy.*
3. *Wheel chart tests* for astigmatism.

METHODS OF CONDUCTING STUDY

1. Visual acuity tests were made without glasses and for right eye only. They were given before and after cycloplegic.

2. To assure that group accepting cycloplegic was representative, a control group of 1,000 children who refused cycloplegic was set up and

* No mention of cycloplegia, and degree of errors not reported.

† Method of illuminating chart not specified.

visual acuity for study group was compared with that of control group and also with data from a previous study.*

3. Wheel chart was eliminated with small children as unsatisfactory.

FINDINGS (Presented in tables, graphs, and text):

1. The average child in the study had 0.50 to 0.75 of a diopter of hyperopia. At 6 to 8 years of age the average was 0.75 to 1.00 diopter of hyperopia and at 12 to 16 it was 0.50 of a diopter of hyperopia.
2. The prevalence and degree of hyperopia tended to decrease with age while myopia and astigmatism increased in frequency. This increase was greatest before 11 years of age.
3. Before cycloplegic, 66 per cent had a visual acuity of 20/20 or better, while after cycloplegic only 21 per cent could read the 20/20 line; before cycloplegic only 7 per cent tested as low as 20/50 while after cycloplegic 43 per cent tested 20/50 or less.
4. Retinoscopic examination revealed some degree† of hyperopia or hyperopic astigmatism in 88 per cent; mixed astigmatism in 1 per cent; myopia or myopic astigmatism in 7 per cent; emmetropia in 4 per cent. Twenty-eight per cent of all children showed some form of astigmatism. Eighty per cent of the cases of astigmatism were with the rule, 5 per cent against the rule, and 15 per cent oblique.
5. The range of refractive error was as high as 6.50 D. of hyperopia (2 children) and up to 11 D. of myopia (1 child).
6. Many of the children with relatively high hyperopia tested 20/20 before cycloplegic (1 child +4.50 D. and 14 with +3 to 4 D.). The large majority of the children with +1 D. or less read 20/20, but very few could read 20/15. One hyperope with 5 D. tested 20/30 while two others with like amount tested 20/50 and 20/70.
7. Of the 144 myopes, when tested before cycloplegic, none could read 20/15 while 31 tested 20/20 with refractive error ranging up to −1 D. Of those with high myopia, the one with −11 D. tested 20/70, while two with −4 D. and −4.50 D. tested only 15/200.

School Eye Surveys. Report on a Grammar School. L. Mills, M.D. *California and Western Medicine*, Vol. XXX, no. 3, March, 1929, pp. 168–70.

PURPOSE OF STUDY

To investigate efficiency of methods used by schools in discovering visual defects or ocular disease in school children.

* Collins, S. D. "The Eyesight of the School Child as Determined by the Snellen Test," *op. cit.*

† Includes all degrees of refractive error, many of which the authors point out are of such slight degree as not to need correction.

GROUP STUDIED

566 grammar school children (6–12 years) in Los Angeles School District (study under auspices of Eye and Ear Advisory Board of School District).

TESTS AND TECHNIQUES EMPLOYED:

Allport combination letter and illiterate chart with and without correction.*

"Eyedness and Handedness Test" to discover dominant eye, convergence near point, pupillary action, muscle balance. (Author's explanation of test: examiner's back to light with child facing him; a plane mirror placed between the eyes about six inches distant and fairly rapidly brought toward the eyes, the child fixing the aperture. In the adult, master eye normally maintains undeviating convergence while non-fixing eye diverges when mirror comes within two inches of eyes. With children, because of abundance of convergence power, the mirror is introduced suddenly at six inches and if divergence does not occur at two inches, it is held in place for a few seconds until one eye yields or the mirror is reversed and the dull back is presented.)

METHODS OF CONDUCTING STUDY:

1. "Evidence of ocular pathology recorded"—"where defective vision, muscle function or pathological changes existed, inquiry was made into presence of symptoms."

2. All cases having defects referred for examination; ophthalmoscope used "where indicated."

3. Referral for examination based on visual acuity of 20/25† or less with or without symptoms or on the presence of symptoms where vision was normal.

FINDINGS (Presented in summary form, no tables, charts or graphs):

1. Visual acuity of 566 children: 82.6 per cent (text gives this as 86.2 per cent)—20/20 or better in each eye; 2.8 per cent—20/20 in one eye, 20/25 in the other; 11 per cent—20/25 in each eye. "The balance . . . scattered through entire practical visual range—lowest visual acuity, 6/60" (20/200).

2. "In general, master eye had better visual acuity in hyperopia and poorer in myopia." Right eye dominant, 69.1 per cent; left eye dominant, 24.3 per cent; no dominance in 5.3 per cent; abduction in 1.2 per cent.

3. Muscle action: normal, 73.7 per cent; excessive convergence, 18.3 per cent: of these, 17.3 per cent showed decided convergence, including 8 cases of alternating strabismus; increased abduction, 8 per cent—usually one eye: of these 13 per cent (6) showed decided

* No data as to techniques of visual acuity test.

† Visual acuity is reported in meters and has been translated into approximate Snellen fractions based on foot measurements.

divergence. "Symptoms were noted in 7.2 per cent of entire group, although 26.3 per cent were found to have some form of muscular imbalance." "Below the third grade fixations were more or less uncertain."

4. Pathological conditions noted "had been recognized by teachers or school nurse and were under treatment or treatment was planned."*
5. "Visual examinations" had been done by school physician and nurse* except for new admissions. Record of previous physical examination not transferred with child.
6. 29 children wore glasses: 16 for "compound hyperopia," 4 for hyperopia, 3 for hyperopic astigmatism, 3 for mixed astigmatism, 3 for "compound myopia." Six children who had been given glasses within a year for over two degrees of myopia or hyperopia "showed decided reduction in vision, indicating that children with moderate to high errors of refraction should be examined yearly at least."
7. Present system effective except in case of transfers and of those wearing glasses.
8. Only 7.2 per cent showed symptoms referable to eyes.

The Vision of Pre-School Children—An Analytical Study of 982 Children. Published by the National Society for the Prevention of Blindness, New York, N. Y., 1930. (Out of print.)

PURPOSE OF STUDY

To investigate the need for vision tests of young children, especially of preschool age, and through their alleviation and correction, to decrease eye defects among school children.

GROUP STUDIED

982 children connected with settlements in New York City; ages 3 to 6 years, except for 136, 68 of whom were "6 years old and over" and the age of the other 68 was not reported. Nationalities included Italians, Polish, Irish, Jewish, English, Chinese, American, Syrian, Colored and Puerto Rican.

TESTS AND TECHNIQUES EMPLOYED

A. By lay testers (nurse)

1. *Snellen Symbol E:* distance, 20 feet; artificial illumination (shedlight), 10 to 12 foot-candles; test objects presented singly by means of black "window cards" with appropriate sized holes; procedure conducted as a game in which Symbol E was presented as an animal with legs (shafts of the Symbol) pointing in a given direction. Child indicated the direction of the shaft by pointing. (Test objects presented in vertical and horizontal positions.)
2. *Muscle balance test* (near): distance, 10 to 12 inches; alternate screen fixation test. A small card was used to cover one eye while

* No data presented on methods.

the gaze of the other was fixed on a large, bright-headed pin; after the covered eye had had time enough to relax, the card was shifted to cover the other eye, the tester observing to note presence of a shift in direction of the gaze of the eye first covered. Procedure repeated for each eye.

3. *Inspection:* (a) size and equality of pupils and light reaction; (b) appearance of eyes and adjoining tissues and general appearance and behavior.

B. By ophthalmologists

1. (No exact statement of the ophthalmological tests); mydriatic in approximately one-half of the 232 children examined by the ophthalmologist. Findings (for those examined) are presented regarding refractive errors, muscle imbalance, abnormal or pathological conditions of eyeballs, lids, and conjunctiva.

METHODS OF CONDUCTING STUDY

1. Selection of vision test chart and development of game technique:
   a. Trial and error used to eliminate pictograph and Landoldt Broken Circle Chart.
   b. Experimentation to develop device (black "window cards") to concentrate attention.*
2. Development of muscle balance and inspection procedures: game technique worked out experimentally by nurses.*
3. Nurse referred for ophthalmological examination those she suspected to have defects. Such referrals were based on: visual acuity 20/40 in worse eye, with or without other symptoms; muscle balance test; observation or history of symptoms, regardless of visual acuity.
4. Ophthalmological examination only for those referred by nurse.
5. Ophthalmological examinations made by twelve ophthalmologists ". . . the ophthalmologists followed their usual office practice with regard to the use of mydriatic in particular cases . . ."

FINDINGS (Presented in tables, charts, graphs, and text)

1. Analysis of nurse's findings: 982 children
   a. Disposition of cases: dismissed as apparently normal, 632; referred to ophthalmologist, 350; examined by ophthalmologist, 232; "lost cases," 118.
   b. Symptoms leading to referral: visual acuity 20/40 or less with or without other symptoms, 189 children; visual acuity 20/20 or 20/30 with symptoms or history, 129 children; "other symptoms" leading to referral include: squint or suspected muscle imbalance, 143 children; inflamed lids, conjunctiva, sclera, or congestion of cornea, 209 children; irregularities of cornea, iris, or pupils, 13; sensitivity to light or slow light reaction, 18; blinking, itching,

* Details as to figures and experimental methods not presented.

tearing, pain, 4; frowns, headaches, slow reading, 44; unusual positions of head, neck, or shoulders, 39. (Eighteen of the children referred had a visual acuity of 20/200 or less in one eye without correction.)

2. Analysis of ophthalmologists' findings: 232 children
   a. On the basis of the findings for those examined, it was estimated that 20.9 per cent of the entire group of 982 children had some abnormality. On the same basis, it was estimated that:
      18.0 per cent had refractive errors.
      4.7 per cent had squint or muscle imbalance.
      2.8 per cent had inflammations of lids or conjunctiva.
      1.4 per cent had abnormal conditions of the eyeball.
   b. Visual acuity with and without mydriatic is recorded for 212 eyes. Most of the children showed a much lower visual acuity with mydriatic than without. Of 41 children whose vision was 20/20 without mydriatic, only 2 had an equal visual acuity with mydriatic while 10 had only 20/200.
   c. The percentage of children with a visual acuity of 20/20 or better without mydriatic ranged from 16 per cent in the 3 and 4 year olds to 58.9 per cent in the 6 year olds and over, with 31.6 per cent of all of the children able to read 20/20. There was a corresponding decrease in the number whose visual acuity was recorded as 20/30. There was no apparent trend in the figures for visual acuities of less than 20/30. There were more girls than boys in the 20/30 and 20/40 groups.
   d. There were more girls with refractive errors than boys (19.4 versus 16.8 per cent). The incidence of specific refractive errors was: hyperopia, 7.1 per cent; compound hyperopic astigmatism, 7.5 per cent; simple hyperopic astigmatism, 1.6 per cent; myopia and myopic astigmatism, 1.3 per cent; mixed astigmatism, 0.3 per cent. The range of refractive errors was in the case of myopia (23 cases) from under 1 (8 cases) to 10 D. (2 cases); hyperopia (312 cases) from under 1 (85 cases) to 7 D. (1 case).
   e. Squint or muscle imbalance was reported in 46 cases. (This included all who showed tendencies to squint, however slight.)
   f. Abnormal conditions of the eyeball were noted in 14 cases. (The types of abnormalities were not indicated.)
   g. Inflammations of lids or conjunctiva, 28 cases.
   h. There were 26 children who were referred by the nurse as probably needing care whom the ophthalmologist found to be normal.

CONCLUSIONS

1. Latent squint in early age group as brought out by the cover test may be more frequent in preschool children than has been generally thought.

2. Visual acuity may tend to improve during the years of 3 to 6 years.

3. The figures as to nationalities seem to indicate a high rate of squint and low rate of astigmatism among children of Irish parentage; compara-

tively high rate of myopia and astigmatism among Chinese; with a consistently low rate of astigmatism for the colored group.

4. 75 per cent of the refractive errors were between +3 D. of hyperopia and −3 D. of myopia.

5. No marked tendencies were discovered to indicate any correlation between the incidence of abnormalities of the eye and of other physical defects commonly noted in examinations by pediatricians.

6. The largest contribution of the study was believed to be the development of a technique of visual testing for little children which was based on sound psychological principles.

Eye Health Study of Texas School Children. J. G. Jones, M.D., F. M. Hemphill, and J. M. Pinckney. Bureau of Nutrition and Health Education, The University of Texas, Extension Division, Austin. 1934.

PURPOSE OF STUDY

To determine the eye health problems of Texas school children, with a view to planning a health education program.*

GROUP STUDIED

5,748 white school children, grades I to XI.

TESTS AND TECHNIQUES EMPLOYED

1. *Snellen E* in electrically lighted cabinet; room darkened (intensity of chart and room illumination not stated); test objects presented singly by use of window cards; distance, 20 feet; both eyes open during test with one occluded by small card. Testing begun at 20-foot line, larger lines used only for those unable to read 20/20.

2. *Inspection:* eyelids, eyes, pupils, pupillary light reaction, conjunctiva, cornea, co-ordination of movements.

3. *Muscle balance:* alternate screen test of fixation. (Large-headed pin held 12 inches from child's eyes, each eye covered alternately, tester watching for movement as cover was removed.)

4. *Ophthalmological examination* (1,162 of group): refraction (with mydriatic, except if parents objected or "in instances involving mild lid or conjunctival condition"), retinoscope, trial lenses, and phoropter (battery of lenses and prisms for checking retinoscopic measurements).

METHODS OF CONDUCTING STUDY

1. Ophthalmological examination for those screened out on above tests (written consent obtained from parents). Bases of referral: inability to read 20/20 with either eye, with or without symptoms; slowness in reading chart; symptoms (not defined or listed); muscle imbalance (apparent or suspected because of observed shift during test); reports of accidents; requests of parents or teachers.

* As study includes much extraneous to the digests, only pertinent sections are included.

2. One lay tester checked visual acuity, another muscle balance and inspection of eyes. One ophthalmologist made all the ophthalmological examinations.

3. Results tabulated to show basis of referral numerically, by percentage and by grades.

FINDINGS

A. Analysis of preliminary tests

1. On the basis of preliminary tests, 23.8 per cent were referred for ophthalmological examination. Of total group, 12 per cent unable to read 20/20, defects of conjunctiva noted in 4 per cent, signs of muscle imbalance in 2 per cent, and other signs of eyestrain in 10 per cent.

2. The percentage of children with less than 20/20 vision in either eye increased from 9.4 per cent in first grade through the fifth grade (14.5 per cent), then decreased to ninth grade when it became approximately stable at about 9 per cent.* The majority of those unable to read 20/20 could read 20/30 or 20/40.

3. Muscle imbalance appeared to decrease after third grade.

4. A study of the age-grade factor showed that of the 1,359 referred for ophthalmological examination, many more were over-age for grade than were under-age. Over-age frequency decreased from the ninth grade on "because of withdrawal from school."†

B. Analysis of ophthalmological findings

1. Of 1,359 referred, 197 were not examined, 251 were found normal, significant refractive errors‡ were found in 673, strabismus in 73, and pathological conditions in 277 (including the 73 classified as strabismus).

2. Significant refractive errors‡ (found in 673 out of 1,162 children):

Hyperopia	433 children
Hyperopic astigmatism	416 children
Myopia	201 children
Myopic astigmatism	103 children
Mixed astigmatism (not included above)	41 children

3. Analysis by grades and type of error of the cases with one or more diopters of refractive error increased in frequency of hyperopia from the first to the fourth grades, then declined through the

* The point is not mentioned in the text, but from tables there did not seem to be any evidence of a corresponding increase in the prevalence of visual acuity of less than 20/40 in children in these grades.

† The age-grade factor was not analyzed in relation to the ophthalmological findings.

‡ Footnote explains classification of significant refractive errors as those with one diopter or more of hyperopia, one-third diopter or more of astigmatism, or one-quarter diopter or more of myopia.

tenth grade and increased sharply in the eleventh grade. (The proportion of hyperopes to the total number having refractive errors was progressively lower as grades advanced.) There was more myopia in the upper than in the lower grades, marked increase being found in the fifth grade and continuing more gradually to the tenth grade, with another large increase in the eleventh. The prevalence of hyperopic astigmatism remained approximately static in all grades while the 10 cases of myopic astigmatism were found scattered in six different grades.

4. Visual acuity (Snellen test) showed a fair degree of correlation with the presence of significant errors, especially with myopia; but high refractive error was sometimes found in children with good visual acuity rating and vice versa.
5. The association of headaches with a low rather than a high degree of error was interpreted as indicating that those with gross errors learn to tolerate their defects.
6. Girls showed a higher prevalence of all types of refractive errors than boys.
7. Of the 332 wearing glasses, 121 had had ophthalmological examination before the glasses were fitted; the examining ophthalmologist found no significant error in 51 and found 81 wearing glasses at variance with his findings of refractive error.
8. Of the 73 cases of strabismus, 68 were convergent, 2 divergent, and 9 alternating. (No indication of degree of deviation from normal classed as strabismus.) The majority were found in the first four grades.

NOTE: No estimation is made of the prevalence of visual defect in the entire group. Such a figure would have to be estimated as the group given ophthalmological examinations represented only those selected as suspected of having defects.

An Evaluation of the Incomplete Square Test of Visual Acuity for Young Children. R. L. Wilder, M.D., K. A. Petrie, M.D., and J. L. Marquis, Ph.D. *American Journal of Diseases of Children*, vol. 50, Nov., 1935, pp. 1182–1186.

PURPOSE OF STUDY

To find a test for visual acuity applicable to children not able to read letters, to determine a practical set of standard conditions for testing and the reliability of test under these conditions.

GROUP STUDIED

17 children, 5 to 6 years of age, at Institute of Child Welfare, University of Minnesota.

TESTS AND TECHNIQUES EMPLOYED

1. *Visual acuity* tested with incomplete square. The test object was a single broken-square figure (Jackson's): 9 mm. square, sides filled for

a distance of 3 mm., opening 3 mm. wide, placed in center of a 10 cm. square of white cardboard.*

Technique: Child indicated by pointing the direction of shafts of square which was shifted in vertical and horizontal positions. A large blank white card was placed on the wall as a background. Tester held test card against this background. Room darkened by drawing shades; chart lighted by 100 watt Mazda lamp in student lamp reflector, placed 35 cm. from chart.† Floor marked off at 1-meter distances (39.37 inches) to 10 meters (32.8 feet). Testing started at 10 meters with four trials, the square being rotated to each of the four cardinal positions. If mistake was made, the child was moved forward 1 meter until distance was reached where with both eyes together he could read the test in all four positions. Each eye was then tested separately starting again at the 10-meter line. ("Three correct readings at a distance of 10 meters is normal vision, according to Jackson."*)

2. *Snellen E* test at a distance of 10 meters (other techniques not indicated).

METHODS OF CONDUCTING STUDY

1. 14 of the group tested 10 times with broken square test at intervals of 3 to 10 days and twice with Snellen E.
2. Total errors on 10 trials with broken square correlated with total errors on Snellen E.
3. Data for right and left eye combined for second correlation.
4. Correlations calculated for errors on certain trials of test and total errors for all 10 trials, the data for right and left again being combined.
5. Visual acuity was expressed in a fraction, the numerator indicating the size of the test object (10 meter size) and the denominator the greatest distance in meters at which correct reading was obtained.

FINDINGS

1. After the first trial, a child's performance was consistent through the 10 trials.
2. Three trials correlated 0.931 with 10 trials.
3. The best measure of visual acuity (with broken square) was obtained from trials 2 and 3.
4. "The broken square is a reliable and practical test for visual acuity of preschool age children" (as tested against tests with the Snellen Symbol E).

* In a table of visual acuity equivalents, E. Marx (Berens, *The Eye and Its Diseases*, p. 173) gives the following regarding sizes of test objects:

20/20 (6/6) size object = 8.86 mm. with limbs of 1.77 mm.
20/30 (6/9) size object = 12.27 mm. with 2.65 mm. limbs.

† No indication in foot-candles of intensity of chart light or room light.

Editorial

Vision Testing Procedures

IN ANOTHER section of this issue, the REVIEW presents the first installment of abstracts of material pertinent to "screening procedures" for the discovery of probable eye defects or disease.

Ideally, everyone should have periodic eye examinations by a competent eye physician (oculist). This is especially important for young children in the active, growing years, and for persons in mid-life and later, when degenerative changes occur. However, since such service is not universally available, it has been found desirable by health agencies to develop, as a supplementary service, procedures suitable for use in screening out for careful examination those suspected of having eye difficulties.

For the widest application, these procedures must be of such a nature that they can be used by general medical practitioners, nurses, teachers, or "lay" personnel. They should be sufficiently accurate to discover significant eye conditions and they should be simple and easy to use. Facilities available in the agencies using these tests vary greatly as to personnel and equipment, and there is also variation in the age groups served; therefore, these tests must be adjustable to be useful in many types of situations.

As will be readily seen, problems involved in the development and use of the various visual screening procedures include not only the development of tests which are ophthalmologically sound, but important problems of administration and of psychology. Thus this is a field which is of interest to a wide range of people, including the personnel who must give the tests, and the administrators of health services responsible for program planning, purchase of equipment, etc., in addition to the psychologists who frequently depend upon these procedures to supplement various psychological tests. That these groups need the expert ophthalmologic guidance seems self-evident.

The National Society for the Prevention of Blindness has long been interested in these problems and is looked to by health per-

sonnel as an authority in this matter. For some time one of its Committees has been investigating published material on various aspects of the problems involved. Data are to be found in various scientific publications, as well as in a few more general types. Recent medical literature contains many reports of studies of the application of various ophthalmological tests to this purpose.

However, as much of this material is not readily available to many whose interest is vital to the success of a widespread program of screening, the Society has decided to abstract and publish some of the material which the Committee has recently reviewed and believes especially pertinent. It is the hope of the Committee that this will lead to critical evaluation of present practices and to collaboration of the various professional groups who are concerned with the vital problem of the early discovery of eye conditions.

—Thomas H. Johnson, M.D.

The Forum

THIS section is reserved for brief or informal papers, discussions, questions and answers, and occasional pertinent quotations from other publications. We offer to publish letters or excerpts of general interest, assuming no responsibility for the opinions expressed therein. Individual questions are turned over to consultants in the particular field. Every communication must contain the writer's name and address, but these are omitted on request.

The Effect of Vision on Reading Ability *

Efficient reading is so necessary for the attainment of success in modern civilization that progressive educators, parents and students are demanding a thorough study and possible solution of the problem of reading ability. Many delinquencies in schools and colleges are attributed to poor reading habits which are often due to defective eyesight. Numerous failures in adult life are due to inability to assimilate printed material rapidly and efficiently. The amount of information necessary to advance the economic and social status of the individual has increased tremendously since the turn of the century. This means that an enormous amount of additional reading is required to attain success in modern life. It also means that the eyes are burdened with almost insurmountable tasks.

The reading problem has become so acute that instructors in most schools, whether public or private, make some attempt to gauge visual efficiency and require eye examinations when necessary. Unfortunately, the problem does not end with perfunctory eye examinations, and it is often necessary to follow through with more tests and such treatment as needed.

A study of 42 cases of reading disability showed that slightly less than half were improved with corrective lenses and orthoptic exercises. The age of the patients varied from eight years to fifty-two years, the average being twenty-three. There were 25 males and 17 females, with three of the males partially color-blind. Only three cases of squint were included in the group. The remainder exhibited

* Presented before the section of ophthalmology of the New York Academy of Medicine, March 18, 1940.

refractive errors, phorias, or fusion difficulties. Hyperphoria was present in only three cases. Glasses were prescribed for the first time in 7 cases, changed in 12 cases, and unchanged in 9, making a total of 28 patients wearing lenses.

Fusion was present in 39 patients—third grade in 26 cases, and second grade in 13. The squint cases showed no evidence of fusion when examined at their deviation. One was a case of amblyopia exanopsia and the other two were alternating squints.

Orthoptic training and corrective lenses gave subjective and objective improvement to 18 cases. There was no improvement in 10 cases, and 14 were seen on two occasions only.

The routine followed in the 42 cases considered in this study consisted of:

1. Determination of vision uncorrected and corrected.
2. Near-point of accommodation without and with correction.
3. Near-point of convergence.
4. Muscle balance by screen test and Maddox rod for distance and near.
5. Prism convergence and divergence for distance and near.
6. Degree of fusion with the hand stereoscope and Ishihara color test.
7. External and internal examination.
8. Manifest refraction.
9. Amplitude of fusion for distance and near on a major amblyoscope.
10. Cycloplegic examination.
11. Post-cycloplegic examination and treatment.

The obvious fact that good vision and muscular co-ordination are necessary for rapid assimilation of printed matter is indisputable. Certain other factors are essential, such as: adequate light, proper environment, ability to concentrate, and good mental and physical health. If the above factors are favorable, there is hope that, by proper correction of refractive errors and orthoptic training, the patient may become an efficient reader, provided good remedial treatment is available. The mechanics of reading should be directed by a trained technician familiar with the various psychic and mental phases of reading. If the ophthalmologist has given the patient the best glasses possible and has increased the amplitude of fusion to allow for good reading, he should be content to have remedial training directed by one more expert in that field. It is often necessary for the ophthalmologist to continue observations and exercises while remedial training is in progress, and it is most important for him to co-operate until results are attained.

Comparatively few people have normal vision in every detail. A person may be able to see perfectly in the distance with both eyes but less

than normal when using each eye separately. Various errors of refraction influence visual acuity for both distance and near. If the errors of refraction are great enough and not corrected properly, the patient's reading progress is impeded. Proper attention should be devoted to possible size differences of the retinal images and the condition of the intrinsic and extrinsic ocular muscles.

Good muscular co-ordination is necessary to make an efficient reader. We often fail to appreciate that there are intrinsic as well as extrinsic ocular muscles which have to work in perfect harmony to attain good binocular single vision. A disturbance of the function of any one of these muscles may be enough to affect seriously the ability to digest printed material. Variations in the near-points of accommodation and convergence, with consequent fatigue, play important parts in the use of the two eyes together. A weakness or over-action of the medial recti muscles frequently results in asthenopic symptoms incompatible with normal reading ability.

The conclusions made from a study of 42 patients complaining of reading disability showed that:

1. Binocular single vision with depth perception or third grade fusion is essential for efficient reading.

2. Cases of heterophoria are helped by orthoptic exercises and refractive correction.

3. Cases of heterotropia are not helped appreciably by orthoptic training and refractive correction.

—Brittain Ford Payne, M.D.
New York, N. Y.

News of State Activities

THIS Section is devoted to the reporting of sight conservation activities carried on by official and voluntary agencies throughout the country. It presents information supplied by these groups, and serves as a medium for exchange of experiences. Only brief and timely items can be used, because of the limitations of space.

District of Columbia

"The District of Columbia Society for the Prevention of Blindness joined the Washington Society for the Hard of Hearing and the Washington Heart Association in a program at the February luncheon meeting of the Health Division, Council of Social Agencies. The President of the Board of Education, who is a member of the Board of the Society for the Prevention of Blindness, prepared a talk on 'Prevention of Blindness in the District of Columbia.' A paper on 'Help Save Their Hearing' was presented by an otologist, and 'Heart Disease in Children' was discussed by a cardiologist.

"The Health Division distributed mimeographed booklets entitled, *Eyes, Ears, Heart,* offering a quiz on these subjects; general information on the visually handicapped, the hard of hearing, and the cardiac; and a directory of clinics and of educational facilities for the handicapped."

—*District of Columbia Society for Prevention of Blindness, Washington, D. C.*

Illinois

"Recently the WPA in Washington asked for some total figures on the two eye testing projects in Illinois. The Chicago Project has been in existence since 1936 and the Illinois Project has been in existence since August of 1938. We had no idea of the scope of these two projects until we actually compiled the figures, which are simply breathtaking.

"It was found that during this period of five years on one project and two on the other, 1,228,949 children had their vision tested. Of that number, 146,082 defects were found, of which 56,087 were 1X cases; 66,513 were 2X; and 23,482 were 3X.

"On the correction program it was discovered that 37,848 chil-

dren have had their vision corrected, which is about a 33⅓ per cent correction. It is to be understood that we do not work for correction on 1X cases, so the 37,848 cases represent a correction program on 2X and 3X cases. It was figured that on the 3X cases we had about a 66⅔ per cent correction, and on the 2X cases about a 50 per cent correction.

"The Down-State Project has operated in 59 counties of the 102 in Illinois. The Illinois Society during the past year has run three training courses for the workers on these projects and extends constant and close supervision over the work."

—Illinois Society for the Prevention of Blindness, Chicago, Illinois

Indiana

"The Committee is sponsoring Legislation on Ophthalmia Neonatorum this year, trying to get the State Health Board interested in trachoma treatment for children. Published eye articles in the May, 1940, issue of the *Indiana State Medical Association Journal.* Held a breakfast conference during the annual meeting of Indiana State Medical Association at French Lick, Ind., in October, 1940."

—Committee of Conservation of Vision for the Indiana State Medical Association

Minnesota

"The November, 1940, packet distributed to physicians by the Minnesota State Medical Association in their 'Co-ordinated Medical and Public Health Program' concerned the prevention of blindness. The following items were included in this packet:

"1. 'The Cross-Eyed Child' (Diagnosis and Treatment), by Hendrie W. Grant, M.D., St. Paul.

"2. 'Common Eye Injuries,' by Erling W. Hansen, M.D., Minneapolis.

"3. 'Glaucoma' (Treatment and Features of Interest to the Internist), by W. L. Benedict, M.D., Rochester.

"4. 'Glaucoma,' by Edward P. Burch, M.D., St. Paul.

"5. 'Safeguards in Cataract Surgery,' by Frank E. Burch, M.D., St. Paul.

"6. 'Blindness Due to Neglect,' by Frank E. Burch, M.D., St. Paul.

"7. 'Some Principles Involved in Surgery of the Extra-Ocular Muscles,' by Avery DeH. Prangen, M.D., Rochester.

"8. 'Causes of Blindness in Minnesota,' by Charles E. Stanford, M.D., Minneapolis.

"This information is given to physicians to aid them in interpreting medical and public health problems to non-medical individuals and groups in the communities in which they practise. To further support the information contained in the packet, an abstract of this material was prepared by Dr. D. A. Dukelow of the Minnesota Department of Health for publication in the *Minnesota Registered Nurse.*"

—Minnesota State Department of Health, St. Paul, Minnesota

Missouri

"The Anti-Fireworks Bill has been introduced in the Missouri State Legislature, entitled House Bill No. 160. It is being actively sponsored by the St. Louis Safety Council, those of the Kansas City and St. Joseph Councils, and this committee is doing everything it can in the support."

—Committee of Conservation of Eyesight, Missouri State Medical Association

Tennessee

"*Sight Conservation Activities in Tennessee from December 1, 1940, to February 14, 1941.*—The statement was made in our last contribution that the survey of the blind of the state, in regard to the causes of blindness prevalent in the state, was about 75 per cent completed, comprising 3,126 cases, of which 455 were children; the major causes of blindness prevalent in the state are as follows:

	Per Cent
1. Cataracts (all types except traumatic)	18.24
2. Foci of Infection	11.70
3. A. Injuries	10.46
B. Sympathetic Disease	1.87
4. Hereditary Eye Conditions	9.86
5. Acute, Infectious and Contagious Diseases	9.14
6. Syphilis of the Eyes	7.52
7. Glaucoma	7.02
8. Refractive Errors	4.19
9. Congenital Eye Defects	3.78
10. Ophthalmia Neonatorum	3.39
11. Miscellaneous Causes (cardiovascular, neoplasms, systemic diseases, pterygia, etc.)	4.76
12. Unclassified as to etiology	8.08
Total	100.01

"On January 30, 1941, a Fireworks Survey was begun, letters being written to 192 eye physicians and general hospitals, requesting that reports on all fireworks injuries to the eyes and other portions of the

body during the period from July 1, 1938, to January 10, 1941, be reported to the Service. To the present date 57 physicians and 35 hospitals, for a total of 92 answers to these letters, have been received, which means that the Survey is 47.8 per cent completed. Sixteen eye injuries were reported, six eyes being lost and one sustaining 90 per cent impairment. Seven burns of the hand were reported, two ruptured eardrums with considerable loss of hearing, and one severe body burn were reported, the latter case being in a little girl who had had sparklers sewed in her dress and who later died. In all, 26 injuries due to fireworks were reported, 14 being in children, two being in adults, and in ten it was unknown whether the injured party was a child or an adult, due to faulty reporting and inability to find records. Twenty-two of these injuries were due to firecrackers, three to torpedoes and one to sparklers. The Service has on record eight other injuries due to fireworks which occurred during the period from July 1, 1937, to July 1, 1938, six being in children and two being in adults, each of the six children losing one eye each, one adult losing both eyes and one adult sustaining a ruptured eardrum with considerable permanent loss of hearing in that ear, all of which were due to firecrackers. This indicates to the Service that Tennesseans should be protected by a Fireworks Law modeled after that which became effective in Pennsylvania in 1939. An unsuccessful attempt was made this year to have such a bill introduced into the legislature, so Tennesseans will be unprotected from these hazards for another two years. Memphis has a well-enforced fireworks ordinance, as is shown by the fact that only four minor burns of the fingers were reported during the two and a half year period for which reports were requested.

"The Centennial Club of Nashville has graciously consented to make available a scholarship of $200 for the training of another sight-saving class teacher at Cleveland, Ohio, this year. At present, three sight-saving classes are in operation with an enrollment of 45 students, and the Service understands that the Memphis sight-saving class, which was discontinued in September, 1940, is to be re-opened this month.

"During this period 57 persons, 48 being children and nine being adults, had varying amounts of sight restored to them in one or both eyes, either by glasses alone, by surgery, or by surgery and glasses. One other adult has had a cataract operation on one eye to restore sight and a needling operation on the other, both being successful, but no report has, as yet, been received on him as to the amount of vision restored.

"Also, during this period total or partial blindness in one or both eyes, either has been or is being prevented to 28 persons, 21 being

children and seven being adults. Seven children are having bilateral blindness from amblyopia exanopsia prevented, one child has had bilateral blindness from secondary glaucoma prevented by an iridectomy and a transfixion operation on the iris and one child may be having bilateral blindness from progressive myopia prevented by glasses, proper medical care and enrollment in a sight-saving class. Eleven children are having partial blindness in one eye from amblyopia exanopsia prevented and one child may be having blindness in one eye prevented from congenital optic atrophy. Five adults have had bilateral blindness prevented, three being from pterygia by surgery, one being from entropion by surgery and one from diabetic cataract by treatment for her diabetes, which is well under control. Two adults are having unilateral blindness prevented, one from amblyopia exanopsia by glasses and the other from sympathetic disease by the enucleation of the injured eye.

"During this period seven talks, six being on the causes of blindness prevalent in the state and their prevention and one being on the need for sight-saving class education in Tennessee, have been made by the Director of the Service, two being made before groups of senior medical students at Vanderbilt University, one before a Parent-Teacher group at Lewisburg, one before the Kiwanis Club at Franklin, one before the Forum Club at Old Hickory, one before the Lions Club of Lafayette, and one before a Special Education group at the University of Tennessee at Knoxville. Approximately 310 persons were reached by these talks. Following the talks at Franklin and Lafayette, the Kiwanis Club and the Lafayette Lions Club have begun co-operative programs with the Sight Conservation Service in the prevention of blindness and restoration of sight to visually handicapped children of Williamson and Macon Counties."

—*Sight Conservation Service, State Department of Public Health, Nashville, Tennessee*

Washington

"This District of the Lions Club is sponsoring legislation in co-operation with the State Department of Education and the Division for the Blind in order to make possible sight-saving equipment, consisting of adjustable desks, clear type books, bulletin typewriters, etc., which can be made available to schools in smaller towns and rural areas when there is not a sufficient number of pupils in the school to warrant the establishment of a sight-saving class. The equipment will be handled on a loan basis by the State Department of Education.

"The Division for the Blind in the State of Washington considers

this an important piece of legislation since it has been found very difficult to arrange transportation and housing for children in the smaller schools so that they can be brought to a central area and thereby have the benefit of a sight-saving class."

—Division for the Blind, Department of Social Security, Olympia, Washington

Hawaii

"*Causes of Blindness Study.*—Grace C. Hamman, director, Bureau of Sight Conservation and Work with the Blind, in collaboration with William John Holmes, M.D., ophthalmologist, has completed a study of the causes of blindness on 340 out of 379 known blind persons in the Territory of Hawaii. This study has been accepted by the American Medical Association for publication in the *Archives of Ophthalmology.*

"*Vision Testing and Medical Follow-up of School Children in Hawaii.*—The Bureau of Sight Conservation and Work with the Blind has the responsibility of the vision-testing program in the schools of the Territory. This activity is carried on by the County Field Workers in sight conservation.

"The policy is to have every child in any school or kindergarten given an annual visual acuity and muscle test and to have every teacher participate in this testing program.

"The field workers hold faculty meetings each September in each school and at this time demonstrate the techniques of the vision testing. The field worker stays in the school to assist and supervise the rough screening. She retests all questionable cases and all persons wearing eye-glasses and any cases whom the teachers refer. After testing is completed, referrals are sent to the families requesting medical eye care on questionable cases.

"The fifteen ophthalmologists of the Territory co-operate in using the eye examination blank which is approved by the National Society for the Prevention of Blindness.

"The field worker's duty after the testing is completed is to make arrangements so that every child referred has adequate medical attention. For the school year 1939–1940, 50,757 children came under this program. There was a total of 3,251 visual defects; 2,914 were referred to eye physicians. The difference of these two numbers is that cases of totally blind eyes by accident or artificial eyes are not referred yearly. Of this number, 2,429 received medical eye follow-up and there are on file the signed examination papers of 2,409 cases.

"We feel that this program is the key-note of our prevention of blindness activities.

"In co-operation with the Federal Social Security Department,

who allots funds to the Territorial Board of Health, the Bureau of Sight Conservation and Work with the Blind have had 144 eye operations for strabismus, ptosis and cataract during the last three years under Services to Crippled Children.

"The territorial definition of a crippled child includes these types of eye defects.

"*Eye Clinics in Hawaii.*—For the school year 1940–1941 the Bureau has completed nine eye clinics held in communities where the regular services of an ophthalmologist are not available. The field worker for each county organizes and supervises these clinics. They are usually held immediately following the vision-testing program in the public schools."

—*Bureau of Sight Conservation and Work with the Blind, Honolulu, Hawaii*

Note and Comment

Society's Program during the National Conference of Social Work, June 1–7.—The Society is again pleased to announce its participation in the National Conference of Social Work. The Society will maintain an exhibit and conference booth, and expects to have an opportunity of arranging consultation for any visiting social worker interested in any aspect of prevention of blindness or sight conservation work. Following is the program:

National Society for the Prevention of Blindness, Inc.

ASSOCIATE GROUP, NATIONAL CONFERENCE OF SOCIAL WORK
ATLANTIC CITY, NEW JERSEY
JUNE 1–7, 1941

General Chairman: ELLEN POTTER, M.D., Director of Medicine, New Jersey Department of Institutions and Agencies

Vice-Chairman: MARCELLA S. COHEN, Supervisor, Prevention of Blindness Department, Pittsburgh Branch, Pennsylvania Association for the Blind

Secretary: ELIZABETH G. GARDINER, Medical Social Worker, National Society for the Prevention of Blindness

MONDAY, JUNE 2, AT 2 P.M.

Helping America by Saving Sight in Childhood

Through Health Services

Roger E. Heering, M.D., Director, District No. 1, United States Public Health Service, New York, N. Y.

Through Child Welfare Services

Helen Hubbell, Supervisor, Rural Child Welfare Unit, Pennsylvania Department of Welfare, Harrisburg, Pa.

Through Educational Services

Mrs. Winifred Hathaway, Associate Director, National Society for the Prevention of Blindness, New York, N. Y.

Through Integration of Services

Theodate Soule, Director, Social Service Department, New York Hospital, New York, N. Y.

Discussion

(If time permits)

TUESDAY, JUNE 3, AT 7:30 A.M.

Breakfast

(Place to be announced)

Open only to medical social workers in eye services

THURSDAY, JUNE 5, AT 2 P.M.

Helping America by Saving Sight in Young Adults

Through Selective Service

Arno Town, M.D., Examining Ophthalmologist, Draft Board, New York, N. Y.

Through Industry

Charles F. Kutscher, M.D., Chief Consulting Ophthalmologist, Carnegie-Illinois Steel Corporation, Pittsburgh, Pa.

Through Social Services

Mrs. Ophelia Settle Egypt, Instructor and Field Work Supervisor, Division of Social Work, Howard University, Washington, D. C.

Discussion

Preventive Ophthalmology in Eire.—Miss Euphan Maxwell's very interesting address to the Irish Ophthalmological Society reveals the status of the prevention of blindness movement in Ireland following the foundation of the National Council for the Blind in 1921 and its prevention of blindness committee five years later. Ophthalmia neonatorum has been reportable in Dublin since 1928, but the trend in this direction has not as yet become country-wide. She pleads for the organization of special classes for oral instruction in schools where there are numbers of "partially sighted" children.

Although children leave school in Eire at the age of 14 years, Miss Maxwell feels it might be possible to allow a child with progressive myopia to continue attending the medical inspections of his previous school until he has reached the "more stable age of 16 years." In 1939 a public health nurse was appointed in Clare for the treatment of trachoma patients under the supervision of the county ophthalmologist. She says that "if hygiene were introduced as a compulsory subject in all schools and means found for the prevention of overcrowding, succeeding generations would know it no more." With regard to eye accidents in industry, although there are no statutory requirements in Eire for the provision or use of protective devices, employers realize their moral responsibilities and conditions are improving. At the present time "sight-testing" of workers in factories is done only in the case of entrants under 16 years of age. Because of the high incidence of ocular complications in venereal diseases, the state grants 75 per cent of net expenditures on treatment to local authorities; there are nine centers for treatment in Ireland. At the time of writing, only five of the 64 hospitals in Eire had a social worker. In her final remarks, Miss Maxwell expresses a hope for state regulation for opticians which "would not only secure a universally high standard of efficiency, but would serve to maintain the honor and dignity of a body which forms one of medicine's most highly valued ancillary services."

The Place of Local Societies for Prevention of Blindness.—During the last annual meeting, the Society had the privilege of having as its presiding officer, vice-president Russell Tyson, who discussed at the meeting of the Board the subject of the place of local state societies for prevention of blindness. In addition to describing the broad and varied program of the Illinois Society for the Prevention of Blindness, of which Mr. Tyson is president, he said in part: "Speaking for the Illinois Society for the Prevention of Blindness, we consider ourselves primarily a demonstrating agency and that our job is to work with public agencies and gradually to incorporate into public programs projects which will eventually wipe out unnecessary blindness in any given state."

Among the activities of the Illinois Society described by Mr. Tyson were the following topics: "Baby Work," "School Work,"

"Trachoma Work," "Glaucoma Work," and "Accidental Blindness."

The Red Cross and Conservation of Vision.—The Fourth Pan-American Red Cross Conference took place in Santiago, Chile, December 5–14, 1940. We note with interest that "the campaign against trachoma, the prevention of blindness and aid to the blind" are cited under the Health and Social Assistance Section in the Agenda of the meeting.

Fourth of July Fireworks Accidents in 1940.—Fireworks injuries resulting from the celebration of the Fourth of July in 1940 totaled 4,462, according to a summary published in *The Journal of the American Medical Association* on December 28, 1940. These included 214 serious eye accidents, 15 of which resulted in blindness in one or both eyes. There were eight deaths directly resulting from the use of fireworks and other explosives. The report is compiled from newspaper clippings and questionnaires sent to hospitals, but many injuries are unrecorded; the statistics do not include accidents treated in physicians' offices or in hospitals which failed to report.

"The effectiveness of adequate state legislation in reducing the toll of fireworks injuries has been demonstrated again," *The Journal* of the A.M.A. comments. "With the exception of most of the Southern states, which do not celebrate the Fourth of July extensively with fireworks, there are few exceptions to the rule that only those states which have enacted and enforced state-wide laws have shown evidence of satisfactory control. The injuries and deaths still resulting from this unnecessary cause clearly illustrate the need for additional legislation and consistent enforcement."

New York, as in most of the preceding years, headed all other states in the number of fireworks injuries in 1940, the figure being 1,114; and 32 of these were major eye accidents, four of which resulted in the loss of vision of one or both eyes. A great improvement in New York for 1941 is anticipated, however, because of the state ban on fireworks which is now effective.

Rhode Island had the worst fireworks record of any state in 1940

on the basis of population. It had 239 injuries, including three serious eye accidents.

The need for stricter enforcement of the anti-fireworks law in New Jersey is obvious from the fact that this state, one of the first to adopt such legislation, has shown a steady rise in the number of Fourth of July injuries during the past four years. A total of 158 injuries, including eight serious eye accidents, was reported last year.

On the other hand, Indiana showed a great improvement when its law against fireworks went into effect for the first time last year. There were only two injuries reported in 1940 as against 198 in 1939. The record of Indiana, in the matter of Independence Day injuries and deaths, has changed from one of the worst to one of the best.

Maryland has had a repeatedly bad record but has not yet enacted satisfactory legislation; there were 211 injuries reported from that small state in 1940, including nine serious eye accidents.

Pilot Fitness, A Safety Factor in Aviation.—Pointing out the fact that the need for testing the fitness of pilots for flying has been overshadowed by the development of instruments and the stress laid upon them as a guide for flying, Ferree and Rand describe, in a recent issue of the *British Journal of Ophthalmology*, a new instrument that permits sensitive tests of pilot fitness. This instrument, which they call an electrical multiple-exposure tachistoscope, was designed particularly for measuring the speed of adjustment of the eyes for change of distance, speed of accommodation and adaptation, and for testing ocular and general fatigue. In addition to its clinical applications, the authors point out that the instrument may be used as: (1) a test of vocational fitness in all cases in which dynamic speed of vision is an important requirement; (2) a test of pilot fitness for aviation; (3) a specific performance test of fitness for night flying; (4) a test of disturbance in fitness due to altitude; (5) a limiting test for age as a factor in fitness; (6) a means of measuring ocular fatigue and recovery, of testing individual susceptibility to fatigue and capacity to recover, and of detecting disturbances in fitness from other causes such as loss of sleep, worry and all mental

states that distract attention, etc.; and (7) as a means of training eyes to greater oculomotor and accommodative facility.

Louis Resnick.—We announce with sorrow the death, on March 18, of the Society's industrial relations director, Louis Resnick, who was a member of the staff since 1922, except for a period of several years when he was on a leave of absence to serve as the first director of the Informational Service of the Social Security Board and as public relations consultant to the International Labor Office. By a rising vote the following resolution was adopted by the Executive Committee of the Society for the records:

"The National Society for the Prevention of Blindness, in executive session on this eighteenth day of March, 1941, learns with sorrow and with a deep sense of loss of the death of Louis Resnick, a member of the staff of the Society for nineteen years.

"Mr. Resnick joined the Society as Publicity Director in 1922. Through his wide experience as reporter, editor and publicity director of many organizations he was able to make the activities of the National Society for the Prevention of Blindness known, not only throughout the United States, but in other countries. In 1928, because of his growing interest in and his thorough knowledge of industrial welfare, he was appointed Industrial Relations Director.

"For some time Mr. Resnick was on leave of absence for government service, but kept in close touch with the National Society and later returned for active work. In 1924 he revised 'Eye Hazards in Industrial Occupations,' bringing the material up to date and adding much new subject matter; during the past year he was engaged in rewriting the publication, which is now ready for the press.

"Louis Resnick was a man of vision. His keen mind was ever on the alert to discern new trends. He was recognized as an authority in publicity, editorial and industrial work. He arranged and took part in many conferences. His articles and editorials appeared in a vast number of newspapers and magazines. He was an indefatigable worker, never sparing his time or his talents. His life was one of service to humanity and its influence will reach out into the future.

"It is resolved that this memorial be spread on the minutes of the Executive Committee meeting and that copies be sent to his devoted wife and family."

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"The National Society for the Prevention of Blindness, in executive session on this eighteenth day of March, 1941, learns with sorrow and with a deep sense of loss of the death of Louis Resnick, a member of the staff of the Society for nineteen years.

"Mr. Resnick joined the Society as Publicity Director in 1922. Through his wide experience as reporter, editor and publicity director of many organizations he was able to make the activities of the National Society for the Prevention of Blindness known, not only throughout the United States, but in other countries. In 1928, because of his growing interest in and his thorough knowledge of industrial welfare, he was appointed Industrial Relations Director.

"For some time Mr. Resnick was on leave of absence for government service, but kept in close touch with the National Society and later returned for active work. In 1924 he revised 'Eye Hazards in Industrial Occupations,' bringing the material up to date and adding much new subject matter; during the past year he was engaged in rewriting the publication, which is now ready for the press.

"Louis Resnick was a man of vision. His keen mind was ever on the alert to discern new trends. He was recognized as an authority in publicity, editorial and industrial work. He arranged and took part in many conferences. His articles and editorials appeared in a vast number of newspapers and magazines. He was an indefatigable worker, never sparing his time or his talents. His life was one of service to humanity and its influence will reach out into the future.

"It is resolved that this memorial be spread on the minutes of the Executive Committee meeting and that copies be sent to his devoted wife and family."

Current Articles of Interest

Treatment of Inclusion Conjunctivitis with Sulfanilamide, Phillips Thygeson, M.D., *Archives of Ophthalmology*, February, 1941, published monthly by the American Medical Association, 535 North Dearborn Street, Chicago, Illinois. Dr. Thygeson reports in this article on the results of sulfanilamide therapy with cases of inclusion conjunctivitis in infants and adults, as well as in cases of the experimental disease in baboons. He first cites treatment of four baboons with the condition, treatment having been instituted within one week after the onset of the disease. The conjunctiva returned to normal within two weeks in two of the animals, and in the other two all inflammation disappeared, although follicles still persisted at the end of the period of treatment. Four adults—two having predominant follicular hypertrophy and two having a more severe condition and showing predominant papillary hypertrophy—responded satisfactorily to the therapy, discharge and inflammatory signs disappearing rapidly and follicular hypertrophy more gradually. The disease responded even more strikingly and rapidly in infants and healed within two weeks; in 70 per cent of the cases there was no subsequent recurrence.

Sulfanilamide therapy produced a striking effect on the microscopic picture of the disease. In all cases the inclusion bodies could be demonstrated without difficulty during the first and second days of treatment, but were either reduced sharply in numbers or absent on the third day and could in no case be found after the third day. The number of leukocytes in relation to the number of epithelial cells rapidly diminished until, by the fifth or sixth day, scrapings contained almost no cells except epithelial cells. Although inclusion conjunctivitis is only rarely complicated by secondary bacterial infection, in three cases where Staphylococcus aureus was present, sulfanilamide seemed to exert an inhibitory effect on the colonies.

In an effort to obtain data on the effect of sulfanilamide on the virus, baboons were inoculated at intervals with material from four patients under treatment. The author found that material taken on the second day of treatment, when numerous inclusions could

still be demonstrated, failed to infect baboons in two of three instances. On the other hand, material from two patients produced infection in baboons on the fifth and sixth days of therapy respectively, at a time when inclusions could no longer be demonstrated in epithelial scrapings. The author feels that, although the experiments were too few to permit conclusions to be drawn, the findings would confirm the opinion that the baboon inoculation test is more sensitive than the microscopic one for determining the presence of the condition.

Dr. Thygeson treated two infants locally with a saturated solution of sulfanilamide in physiological salt solution. Although no effect was obtained in the first case, its use in the second case every fifteen minutes during the day and every hour during the night for seven days was temporarily beneficial. He suggests that further experimentation with other preparations that would obtain a more prolonged action of the drug would seem to be in order.

A Survey of Superficial Punctate Keratitis in Tasmania with the Record of a Mild Epidemic, J. Bruce Hamilton, M.D., *British Journal of Ophthalmology*, January, 1941, published monthly by the British Journal of Ophthalmology, Ltd., London, England. Dr. Hamilton reviews his findings from 92 cases of superficial punctate keratitis culled from 6,662 consecutive case records—a case incidence of 1.38 per cent. The condition is caused by a virus infection of the trigeminal nerve, and Dr. Hamilton believes the same virus is responsible for multiple corneal erosions, marginal keratitis, dendritic ulcer, and disciform keratitis. Superficial punctate keratitis is more common in males than in females, and, although in this epidemic there seemed to be no seasonable variations, Dr. Hamilton did note that the disease was often accompanied by respiratory tract infections. Although the disease is transmissible, in this epidemic it did not appear to be infectious; in only two instances was an immediate relationship found between the patients, and that was slight. There seemed to be no acquired immunity; of the 25 patients who had attacks in both eyes, six appeared simultaneously, but in another nine there was an average interval of 78 days, ranging from two days to 18 months. Sixteen patients had a relapse in the same eye after an interval of from three days to four years.

Bilateral infection seems much more frequent in Tasmania than in other parts of the world, Dr. Hamilton found from a review of other series of case reports. He cites as associated conditions in this epidemic the following: marginal keratitis, the most frequent of the allied conditions; corneal ulcerations; dendritic ulceration; Neisserian iritis; phlyctens—which he believes are not a manifestation of the disease under review, but a separate concurrent lesion; folds in Descemet's membrane; hordeolum; herpes facialis; conjunctivitis and warts of the lid.

Dr. Hamilton states that the severity of the disease in Tasmania has been such as to prevent the patients from continuing their occupations on account of lacrimation and pain. Formerly the use of mild drops and lotions was employed, but, by painting the conjunctival surface of the lids with two per cent silver nitrate, the average duration of treatment has been reduced from 26 days to 7.3 days. He also found that, if a final application of the silver nitrate is made to the lids after the corneal lesions disappeared, relapses were diminished. The use of vitamin A therapy is also suggested.

The final visual results of this epidemic were determined in only 45 cases and in five of these there was mild deterioration of vision. Dr. Hamilton concludes, however, that superficial punctate keratitis does not appear to have any relation at all to the causes of blindness in Tasmania, either directly or indirectly.

Book Reviews

REAL LIVING: A HEALTH WORKBOOK FOR BOYS IN SENIOR HIGH SCHOOLS. Ross L. Allen, Dr.P.H. Book II. New York: A. S. Barnes & Co., 1939. 68 p.

As stated in the introduction, Book II of ***Real Living*** deals primarily with community hygiene and is an application to community living of the individual health problems met in Book I, plus other matters of great interest to high school boys. In explaining the use of the book, the author speaks directly to the boys. This fact, under the guidance of a wise teacher, might immediately be used as a means of inspiring the members of the class to make this study the basis for what might become a very valuable reference book.

Although not arranged on the unit plan as such, the topics are grouped so that the teacher could easily adapt them to the unit plan if called upon to do so. Each topic is prefaced by an introductory talk. Each of these, while informative in itself, leaves enough unexplained to cause the inquiring minds of high school boys, particularly those who are interested in science, to seek further explanation in some of the suggested readings for each topic.

Dr. Ross strikes at the heart of community hygiene through his immediate attack on the problem of communicable diseases, their cause, means of transmission, their control and prevention. His advice on the selection of a family doctor is timely and of great importance to these young people as they approach the age of assuming responsibility in community life as heads of families.

The subject of "Preparation for Marriage" is particularly well presented, and in cities where sex hygiene is included in the course of study, should do much to raise the ideals and standards of the young people. The topic is prefaced by a short study of the endocrine glands and their part in the regulation of body functioning. As presented by the author, sex hygiene is a frank discussion of how nature prepares both boy and girl for the physical and physiological needs of marriage, and of the problems that young people

must learn to meet and solve intelligently, if they are to live a happy, healthful and helpful life.

The chapters on safety are well chosen for high school boys, many of whom step directly from school into industry. The knowledge of traffic and industrial hazards as presented is a definite step toward prevention of such accidents. As a follow-up to highway safety, Dr. Ross presents a chapter on alcohol and tobacco. Here again the study is timely for the boy who is so soon to take his place in a man's world.

As in practically all courses in hygiene, more material is presented than can possibly be covered in the allotted time. However, this type of workbook allows for choice of material to meet the needs of the group.

Perhaps because hygiene, both personal and community, touches human life so closely, much depends upon the teacher, his background, his training, his attitudes. While there is danger that a workbook of this sort might become a prop for the inefficient teacher, *Real Living*, in the hands of a wise, understanding, teacher-counselor, should become a force in the training of future citizens for community living.

—GERTRUDE W. SYME

TEXT-BOOK OF OPHTHALMOLOGY. Sir W. Stewart Duke-Elder. Volume III. Diseases of the Inner Eye. St. Louis: C. V. Mosby Co., 1941. 3470 p. ill.

To write a criticism of the third volume of Sir W. Stewart Duke-Elder's Text-Book of Ophthalmology, entitled "Diseases of the Inner Eye," would be a sacrilege and to present a true appreciation of this monumental work in the allotted space an impossibility.

This volume is a remarkable source of information. It modernizes the literature on pathology and bacteriology in a clear and concise manner.

The illustrations represent the best in English and American literature. The pathologic illustrations credited to Parsons are especially valuable.

This splendid volume provides another milestone in the progress of ophthalmology. When the fourth volume is published, ophthal-

mology will have a remarkably complete treatise on the subject, including an excellent compilation of the literature.

—CONRAD BERENS, M.D.

SAFETY PROGRAMS AND ACTIVITIES FOR ELEMENTARY AND JUNIOR HIGH SCHOOLS. Florence S. Hyde and Ruth Slown. Second Revision Edition. Chicago: Beckley-Cardy Company, 1938. 269 p.

The success of this book is indicated in the fact that this edition is the second revision. As the name implies, this book is designed for the use of elementary and junior high teachers as a source book and for teaching suggestions. The material can be used when safety is taught as a separate subject or when it is integrated with other subjects.

The book consists of three main parts: the organization of safety work in schools; programs for general exercises, safety club meetings, school assemblies and classroom discussions; and projects and accident facts. Safety clubs, councils, and patrols are included. There are also practical suggestions for safeguarding children in various ways. Several plans are offered, so that any given school may adopt the organization best suited to its needs. It should be remembered, however, that less elaborate procedures are usually conducive to the best results. A maze of organization may involve the situation so that the primary purpose of a safety organization is lost to view.

The material for programs is presented by months. If used as suggestions, this type of organization is desirable. It is to be hoped that teachers will use the material in this way. Certainly, if transportation to and from school is a problem, it should be discussed when the problem arises and not be held off until February.

The third part of the book deals with accident facts and school and community projects. This material is presented so that any project refers to the accident facts. Teachers thus can see the relative importance of the topic. There is an excellent bibliography. It may have been helpful to include the price of the book and materials listed. One wonders, however, why certain of the newer series of supplementary materials have been omitted from the lists—by the American Book Company, for instance.

In general, the materials of this book are positive. Just what part

negative presentation should play in safety education has not been determined. Negative suggestions are given in the pictures on pages 77 and 98, and in such statements: "I do not play with candles or lamps," p. 77.

The reviewer would raise the question, "Of what value are slogans in safety teaching?" If the slogan is the point of emphasis, there will be little change of behavior or attitude. If children write their own jingles or slogans from the background of rich experience, the slogan may be useful.

In the early days of health and safety education, there was much emphasis on safety songs and poems. Many classics were distorted to teach safety. Experience has shown that such activities are relatively ineffective in changing behavior for safety. Poems and songs written with other thought in mind should be permitted to remain classics. Safety education should develop its own field of literature.

Each person who plans safety programs for a school should have easy access to this book.

—MARY MAY WYMAN

Briefer Comment

THE PERCEPTION OF LIGHT. W. D. Wright, D.Sc. London and Glasgow: Blackie & Son Limited, 1938. 100 p.

This volume is of special interest to physicists, physiologists, physicians, lighting engineers, road-builders, and public utility and municipal officials. It is based on lectures given by the author at the Imperial College of Science and Technology, and gives a fully illustrated account of many quite recent investigations, some of which have revealed new facts of essential importance.

The contents deal with the relation of illumination and vision to industrial and driving efficiency and hazards. Salient points in visual phenomena are given that are of greatest importance to those concerned with lighting problems and physiological optics. General visual phenomena, vision at high and low intensities, glare, and visual sensations are among the subjects discussed, and the chapter on recent researches in the field is of special interest.

Current Publications on Sight Conservation

Note.—The National Society for the Prevention of Blindness presents the most recent additions to its stock of publications. Except for the more expensive ones, single copies are sent free upon request. Unless otherwise specified, they are reprinted from THE SIGHT-SAVING REVIEW. New publications will be announced quarterly.

344. Rules for Glaucoma Patients, Committee on Glaucoma of the National Society for the Prevention of Blindness. 1 p. (50 cts. per C; $4 per M.) Consists of twelve rules for patients having glaucoma —for distribution by ophthalmologists to private patients and in eye clinics.

345. The Heritage Left by Dr. Park Lewis. A memorial publication in honor of Dr. Park Lewis, consisting of the following papers: 1. Dr. Park Lewis as an Ophthalmologist, Eliott B. Hague, M.D.; 2. As an Internationalist, Lewis H. Carris; 3. As a Founder of the Lay Movement for Prevention of Blindness, Ellice M. Alger, M.D.; 4. As a Friend of Humanity, Charles Pascal Franchot. 20 p. Supplement to Vol. X, No. 4, of the SIGHT-SAVING REVIEW, December, 1940.

346. Protection of Eyesight and National Defense, Mason H. Bigelow. 4 p. ($1 per C; $7.50 per M.) Points out that protection of eyesight is vital to national service, as well as an important economic and social necessity.

347. The Problem of Sight Conservation as Related to the General Program of School Organization, Richard S. French. 8 p. 5 cts. Enumerates some of the responsibilities for sight conservation which face the school.

348. Functional Lighting in the College, John O. Kraehenbuehl. 20 p. 15 cts. Illustrated discussion of lighting for college students, including a sound analysis of the "pros" and "cons" of fluorescent lighting as it is today.

349. Facts and Factors in the Prevention of Blindness Program, C. Edith Kerby. 8 p. 5 cts. Presents the subject of blindness; the prevalence of defective vision; the larger aspects of conservation of vision; and on whom rests the responsibility of preventing blindness and saving sight.

350. The Effect of Vision on Reading Ability, Brittain Ford Payne, M.D. 8 p. 5 cts. Discusses a study of 42 cases of reading disability and the effect on this group of corrective lenses and orthoptic exercises.

D141. Sharing Responsibility for Eye Health, Winifred Hathaway. 8 p. 5 cts. Discusses the teacher's share in discovering visual defects and for taking the steps necessary for correction. Reprinted from the *Elementary English Review*, December, 1940.

D142. Good Eyes for Everyone, Mary Halton, M.D. 2 p. (50 cts. per C; $4 per M.) Emphasizes the need for protecting the sight during the critical growing years. Reprinted from *Parents' Magazine*, March, 1941.

Contributors to This Issue

Mason H. Bigelow, the newly elected president of the National Society, is associated with the law firm of Gould and Wilkie in New York City.

In addition to being superintendent of the California School for the Blind and lecturer in education at the University of California, **Richard S. French** has been president of the Northern California Council for Sight Conservation since 1937.

John O. Kraehenbuehl is professor of electrical engineering at the University of Illinois, Urbana.

C. Edith Kerby is the Society's statistician, and a member of the Committee on Statistics of the Blind.

Eleanor W. Mumford is the associate for nursing activities at the National Society.

Book reviewers: **Gertrude W. Syme** is teacher of health education at Girls' High School, Brooklyn, New York; **Conrad Berens, M.D.,** is director of the Department of Ophthalmology at New York University; **Mary May Wyman** is director of health and safety education for the Louisville, Kentucky, public schools.